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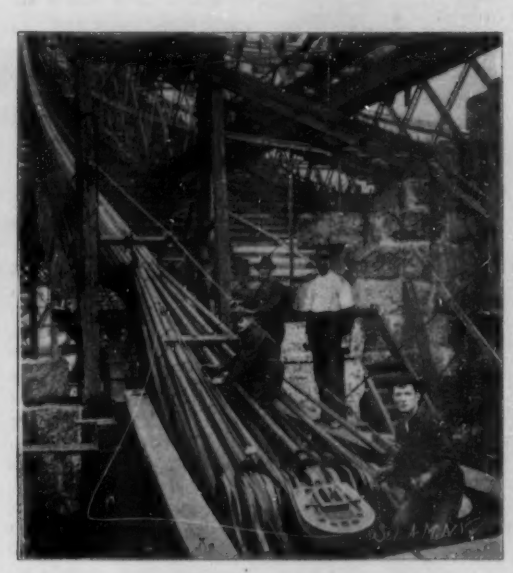
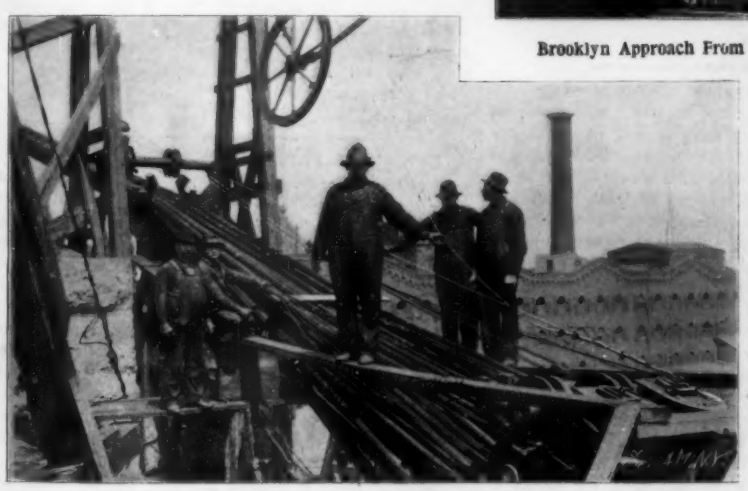
Binding Wire Strands Into Cables.

Brooklyn Approach From Top of Brooklyn Tower.

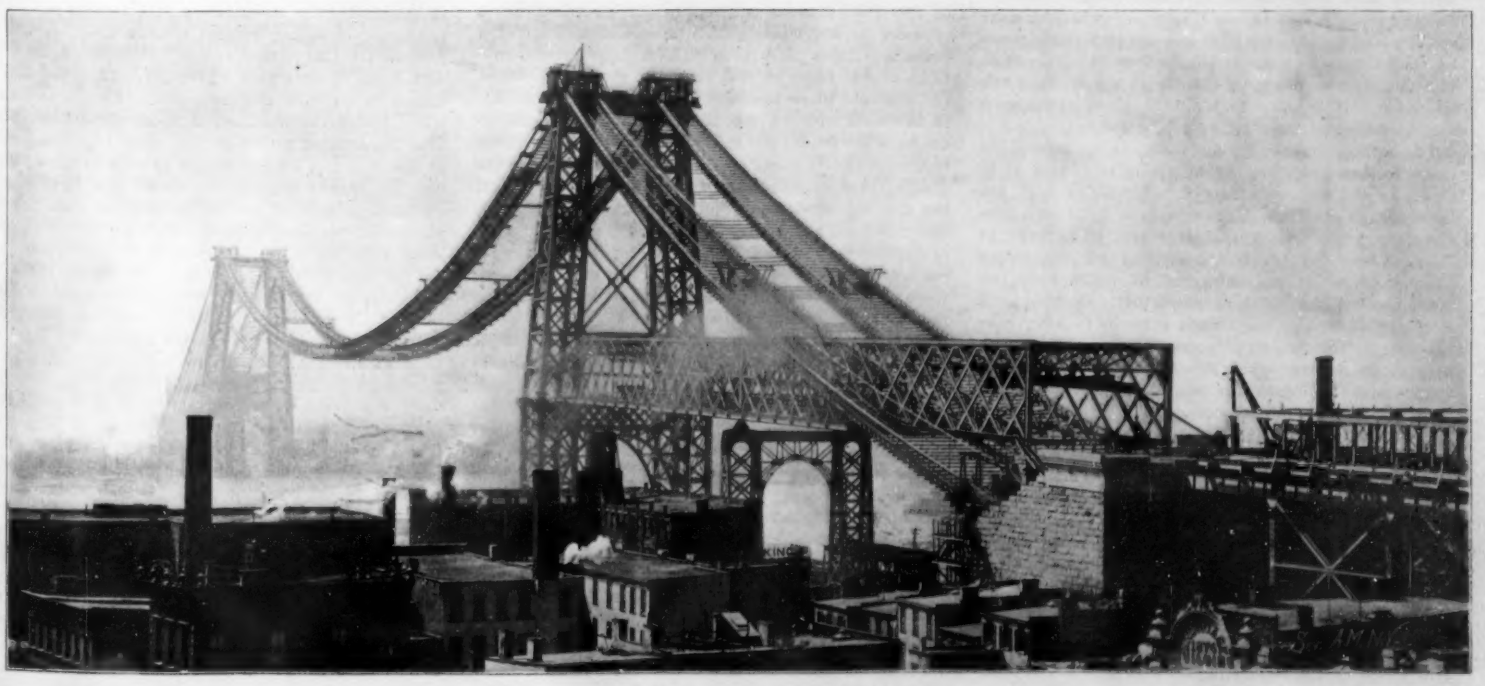


Stringing the Wires.



Compacting Wires Into Cables at the Brooklyn Anchorage.

View From Brooklyn Tower—Showing Foot-Bridge Cables and Towers and Manhattan.



PRESENT CONDITION OF THE NEW EAST RIVER BRIDGE.—[See page 55.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, JULY 26, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE SHIPPING TRUST AND HIGHER RATES

Irrespective of the attitude of the American people toward trusts in general, there is no doubt that the announcement of the formation of the Shipping Trust was received in this country with a distinct feeling of pride and satisfaction. It was felt that the acquisition of various lines purchased by the trust, by which the American merchant marine was augmented by several hundred thousand tons, tended to place it in a position of pre-eminence such as it has not enjoyed since the decadence of shipbuilding in this country following the outbreak of the War of the Rebellion. The movement was looked upon to a great extent as a peaceful victory, made possible by the existing prosperous material conditions in this country. The news of the formation of the trust was received in Great Britain with a feeling which well-nigh approached consternation and led to immediate Parliamentary investigation. This feeling was a perfectly natural one. The possibility that several large fleets of steamers might without warning be transferred from one flag to another was certainly food for much thought and reflection; and even after it became understood that foreign-built ships could not, under our present navigation laws, fly the Stars and Stripes, it was feared that national pride might bring about legislation tending to make such an event possible. It was appreciated, and with reason, that the possible loss to the British Naval Reserve of such magnificent steamers as the "Oceanic," "Teutonic," "Majestic," "Minneapolis," "Minnehaha," and other of the larger ships of the various lines would be distinctly detrimental to England's position as a sea power. This feeling has, of course, been greatly allayed by a better understanding of the laws of this country, which, unless some action antagonistic to the trust should be taken by Parliament, would not admit of any change being brought about in the status of the vessels in question. Those intimately acquainted with shipping interests of both countries have somewhat wondered how it would be possible for the trust to pay dividends upon the enormous capitalization of the company. Very few details in regard to the existing status of affairs, however, have been given to the public; but it is pretty generally understood in shipping circles that the trust has been established for the purpose of making certain combinations with the transcontinental railroad lines, by which freight may be transported over land and sea on advantageous terms. Such a development is in the ordinary course of events and in entire harmony with the spirit of the times, and it is easy to see that great advantages may be derived from such a combination.

The feeling of gratification over the acquisition of these foreign properties, however, is somewhat mitigated by the discovery that simultaneously with the formation of the trust, passenger rates have been substantially advanced. This indeed will be unwelcome news. The rates previously exacted on the better class of transatlantic liners had, it would seem, almost reached the limit of possibility. It will be a matter, therefore, of unpleasant surprise to Americans traveling in Europe to find upon engaging their return passage to America that the rates on some of the steamers controlled by the trust have been advanced from 20 per cent to 35 per cent. It is difficult to foresee what the result of this policy will eventually be. It is problematical whether this increase of rates will not produce a feeling of prejudice against the lines controlled by the trust, and will not perhaps stimulate the establishment of other independent lines offering more popular and alluring rates to the traveling public. It will be an interesting matter to watch what the outcome of the movement will be. The American people form a great traveling public, a large majority of which husband their resources, and carefully consider what the expense of a transatlantic trip would be before starting on a voyage to the other side. Any serious increase in the expense of crossing the ocean may have a material effect in modifying such plans either by discouraging foreign travel or by diverting such custom to other lines not controlled by the trust.

The attitude of the English press has certainly undergone a great change within the last few weeks. The Shipping World, of London, actually welcomes the entry of Americans into the trade. In a recent editorial it goes on to set forth its views as follows:

"There is a vast amount that we can learn from them. It may be worth while to quote a few instances. Take the case of grain. In America 20-ton freight cars bring the produce into, say, Boston. It goes into elevators by machinery, and is passed into the central warehouse, and thence by mechanical conveyors direct into the ship's hold. Compare this with the system at, say, Bristol, where it is actually discharged by hand, or at Liverpool, where, although it is elevated onto the quay or into warehouse, it is busheled and portered by hand, carted to railway depot, and loaded into 5-ton trucks by hand. The railway companies still indulge in a timeworn fairy tale about 20-ton frieght cars being impossible owing to the construction of the sidings, but they forget to explain how Pullman cars are dealt with on these same tracks. The case of coal affords a further instructive illustration. The American designs 5000-ton steam colliers, has them built on the Tyne, tips coal into them at the coaling port, discharges it by grabs onto a wharf, whence it falls into holds or bunkers, and all at a cost of 2s. a ton! Liverpool brings it round from South Wales by 500-ton coasters, often discharges it by hand into lighters, and loads it into bunkers by hand at a cost of 7s. 6d. to 10s. a ton. America builds floating wharves or piers at a cost of thousands, Liverpool spends millions in masonry. America charges so much a day for lying at a wharf. Liverpool for an hour or a month charges 1s. 4d. a ton for her masonry enclaves. Such instances could be multiplied almost indefinitely."

The advanced methods employed in America as set forth in the foregoing describe the conditions as they existed before the trust was formed. There is no reason to believe but that the immense capital controlled by the trust will enable it still further to extend and improve the mechanical conditions as they exist. There is no doubt, however, that any effort to increase the rates in freight or fares will be deeply resented, and the popularity of the enterprise, upon which so much of its prosperity relies, will depend largely upon the policy pursued by the trust with reference to these matters.

THE NEED FOR FIREPROOF ELECTRIC CARS.

A few weeks ago Mr. George Westinghouse wrote a letter to one of our leading daily papers, in which he warned the public against the dangers from fire to which electric cars, particularly on elevated and subway systems, are exposed. If we remember rightly, reference was made to the disaster to the Liverpool Elevated Railroad, in which a whole train was quickly consumed at a point in the line where the road passed from an elevated into a subway structure. It was only by the sheerest good luck that any of the inmates of the train escaped, as the fire, once started, swept through the train with great rapidity. The letter referred to was written at a time when the question of the electrifying of the New York Central Railroad and New Haven lines in this city was under active discussion, and it was intended as a warning against the too hasty assumption that by the substitution of electricity for steam in the operation of railroads, the dangers from fire and other causes would be completely eliminated.

Since the appearance of the letter, which, on account of the distinguished position in the electrical world occupied by Mr. Westinghouse, create something of a sensation, there have been several practical illustrations of the force of the warnings given. On street railway cars there has been something of an epidemic of burnt-out fuses, which, being improperly safeguarded, have set fire to the cars with more or less serious results; and it was only within two weeks that on the Manhattan Elevated Railroad a three-car train caught fire and was completely and quickly consumed. This last accident, although fortunately not attended with any personal injuries or loss of life, for the reason that the train was not in active service, is a much more serious accident than the burning of a street car, for the reason that the chances of escape for the passengers on a street car are favorable, whereas the breaking out of fire on an electric train on the Elevated Road is liable to result in a positively awful catastrophe. Should such a fire occur between stations on a single-track structure, and be accompanied by a complete disablement of the motive power, so that the train were halted between stations, the passengers would be shut up in a veritable fire-trap. The end doors of the train being locked, and the platforms overhanging the edges of the elevated structure as they do, it will be seen that the only chance of escape would be the doubtful expedient of leaping to the street below. If the dangers due to isolation of the train would be great on an elevated road, they would be even greater in a subway tunnel, particularly if it should happen to be a single-track tube; for in this case there would be the added horrors of asphyxiation by the extremely heavy fumes which would be given off by the burning insulation and the heavily varnished woodwork of the car.

By taking every precaution known to modern engineering, it would be possible in the construction of the cars, both as regards the car itself and its electric equipment, to reduce the danger of fire to a point at which it would cease to be a cause of anxiety. In the first place, most careful attention should be given in the construction of the electrical equipment to the question of insulation. The fact that in Europe engineers have been using a 3000-volt current directly on the cars shows that it should not be a difficult matter to so insulate the low-tension direct current which is in use in this country, that fire from a burnt-out fuse or from short-circuiting would be a practical impossibility. A further insurance against fire, not less effective than the first, would be the construction of cars either entirely of metal, or of the best variety of fireproof wood. Of course there are a hundred-and-one kinds of so-called fireproof wood on the market, and many of these are of extremely poor quality, the fireproofing in several cases being only temporary, and rapidly passing off on exposure to the weather. There are some fireproof woods, however, that are worthy of the name, woods that lend themselves to manipulation by woodworking tools, that will take a very fair finish, and varnish well. The combination of the very highest type of insulation with metal or wood fireproofed cars would, we feel perfectly safe in stating, completely eliminate the danger of fire from the electric trains, which within the next three or four years will be running in vast numbers throughout the city and in its suburban service.

That there was nothing over-alarmist about the letter of Mr. Westinghouse, recent events have proved. Unless the methods of car and train construction suggested be complied with, we fear that it will not be many months before another tragedy involving loss of life will be added to the many which have occurred with alarming frequency of late in this city. These methods can be adopted at a cost which will not be in any sense prohibitive; and as we are satisfied that great corporations like the Manhattan Elevated, the New York Central, and the construction company which hopes within a couple of years to open our great subway system, are desirous of making railroad travel perfectly safe, we confidently believe that now, while the question of equipment is under consideration, they will see to it that suggestions of such obvious utility as those indicated above will be incorporated in their rolling stock.

NEW CUBAN PATENT AND TRADE-MARK LAW.

Still another change has been made in the Cuban patent and trade-mark laws, and the Cuban Republic has now an independent patent and trade-mark system.

It will be remembered that when Cuba was a Spanish possession there were two methods by which an invention or trade-mark could be protected in Cuba. The usual procedure was to secure a Spanish patent and have it extended to the Spanish colonies, including Cuba, by registrations in the Spanish colonial office. It was, however, also possible to secure a Cuban patent which was independent of the Spanish patent; though, of course, the property in inventions which were protected in Cuba by Spanish patents, which had been extended to the colonies, could not be affected by the subsequent issue of Cuban patents; neither could inventions which had become public property in Cuba be protected by the issue of a Cuban patent, for the idea in the issue of a patent is always the grant of rights in return for the disclosure of the invention and not the grant of rights without consideration, or the impairment of the rights of the public to an invention which has become public property. This was the situation in Cuba at the close of the Spanish-American war. Under the administration of the United States War Department provision was made for the extension of Spanish and United States patents to Cuba, but it was no longer possible to secure the extension of Spanish patents by merely complying with the provisions of the Spanish law under which the registrations were made in the Spanish colonial office. The United States War Department circulars, which had the effect of law, provided for the protection of inventions in Cuba by the filing of certified copies of United States or Spanish patents in the office of the Governor-General of Cuba. It will be seen, however, that the provisions for the grant of independent Cuban patents were not revoked and that it was still possible to secure patents and register trade-marks in Cuba which were not founded on the grant of a patent or the registration of a trade-mark in another country. This was the law up to June 20, 1902, for the laws of the United States War Department remained in force until they were revoked by the Cuban government. The Cuban authorities have, however, now revoked the laws permitting the extension of United States patents and trade-marks, and it is now necessary to file independent Cuban applications under the Cuban law, which in substance has existed during the Spanish possession and the United States occupation.

The property in patents and trade-marks which were registered in Cuba under the administration of the United States War Department will undoubtedly

receive the full protection of the Cuban law, for it is a principle of international law that private property acquired under one sovereignty will be protected by the succeeding powers.

ST. LOUIS AIRSHIP PRIZES.

It has long been known that one of the features of the Louisiana Purchase Exposition is to be an airship contest. Valuable cash prizes have been offered aggregating two hundred thousand dollars. Of this sum one hundred thousand dollars is offered as a grand prize; fifty thousand dollars has been appropriated for minor prizes for airships, balloons, airship motors, kites, etc.; and fifty thousand dollars has been set aside to pay the expenses incident to the competition.

The contest for the one hundred thousand dollar prize is open to all, without limitation as to the power used or the mechanical principles employed. No applicant will be allowed to compete who does not present satisfactory evidence that he has at some time made a flight over at least a mile course and return with a machine similar in principle to that which he proposes to use in the competition. If this rule is enforced Santos-Dumont is almost sure to carry off the prize. No airship will be admitted to the contest for the grand prize which requires any permanent connection with the earth, or which is not absolutely free in its flight after the start is made.

Four minor prizes are offered of the respective value of three thousand five hundred dollars, three thousand dollars, two thousand dollars and one thousand five hundred dollars; these prizes will be awarded to the four competitors who finish nearest the winner of the grand prize. Each of the contestants, however, must have made the full course three times, each time at an average speed of at least ten miles an hour.

The contestants for these various prizes will sail over an L-shaped course, the legs of which are of unequal length. The shorter leg will be in full view of all parts of the exposition grounds. Three captive balloons will mark the course. The starting point will be at the angle formed by the two legs; each aeronaut may sail over the course in any direction he pleases, but he must encircle the captive balloons in opposite directions. The length of the entire course will be not less than 10 miles (16 kilometers) nor more than 15 miles (24 kilometers) reckoned in an air line from center to center of the captive balloons.

The grand prize of one hundred thousand dollars is to be awarded to the competitor whose average speed during his three fastest trips around the course is the greatest. The competitor at any trial may pass over the course, without stopping, as many times as he desires in a continuous flight, in which case his time will be the average time in which he covers the full course. Such a journey counts, however, as but one trip. The average time made on each of the three trips required must be at the rate of at least 20 miles an hour, including the time consumed in starting and landing.

No exact date has been set for the contest; but it has been decided that the competition must take place between the first day of June and the thirtieth day of September, 1904. The specific weeks for the trials will later be determined by an international jury. Each competitor is to make at least one trial within each of these weeks; but he is at liberty to choose whatever days the exposition gates are open to the public. He must announce the date of his trial sufficiently in advance to permit publication in the morning papers.

A prize of two thousand five hundred dollars is offered for the flying machine, not carrying an operator, which will make a straightaway run of a mile and return to approximately the starting point in the shortest time. Besides its appurtenances, the machine must carry a load of ten pounds. A special course has been laid out for this contest.

A prize of two thousand dollars is offered for the gliding machine, mounted by an operator, which will advance in a calm or against the wind at a vertical angle most acute with the horizon. The machine must make at least twenty glides of not less than four hundred feet each. A prize of one thousand dollars is offered for the gliding machine, mounted by an operator, exhibiting the best automatic stability in the wind during at least forty glides of not less than four hundred feet each. The competitors are permitted to provide special appurtenances for starting and landing.

A first prize of two thousand five hundred dollars and a second prize of one thousand dollars are offered for airship motors other than the machine winning the grand prize, having the least weight and the greatest efficiency in proportion to their power. No limitations as to type are imposed. The motor must, however, have a minimum capacity of one brake horse power, and must not exceed the maximum of one hundred brake horse power. The weight of the motor is to include all appurtenances for a run of one hour. It must be so constructed that it can be attached to an apparatus for making a brake test, and a continuous run of ten hours for ascertaining the trustworthiness and durability of the apparatus.

The man who succeeds in driving an airship motor by energy transmitted through space, in the form of electric radiation or any other form of electric energy, will win a prize of three thousand dollars. At the point of reception, and at a distance of at least one thousand feet, the energy must measure one-tenth of a horse power.

Four prizes of five thousand dollars are offered to the aeronauts who attain the greatest altitude, starting from the exposition grounds; who remain longest in the air; who land nearest the Washington Monument in the city of Washington, D. C.; and who travel the longest distance in one flight in any direction. These contests will be open to balloons, airships and all aeronautical vehicles of any type, carrying at least one person.

A competition for kites will also be held, which will be open to all without limitation as to form or dimensions of apparatus. A competitor may present several kites if he so desires. There will be two classes of kite competition, one for an altitude of five hundred feet to be reached with a line of eight hundred feet in length, and one for the greatest height attained by a single kite flying at the end of a line not less than one mile in length.

In the competition with eight hundred feet of line, three prizes are offered having the respective value of five hundred dollars, three hundred dollars and two hundred dollars. In the competition for height, a first prize of eight hundred dollars, a second prize of five hundred dollars, and a third prize of two hundred dollars are offered. The contests will be each two hours in duration.

The general regulations applying to the aeronautical contests state that hot-air balloons are to be excluded. The exposition will provide a suitable inclosure for the aeronautical grounds, and will defray all necessary operating expenses. Each competitor must provide any special structure or apparatus at his own expense. No competitor will be allowed to furnish his own fuel or manufacture his own gas. The exposition will provide at cost price all gas or fuel.

THE MEERSCHAUM INDUSTRY OF TURKEY.

The British Foreign Office has issued a report upon the meerschaum mining industry of Constantinople. This product which is extensively utilized for the manufacture of pipes is almost entirely confined to Turkey. The meerschaum can be mined by any person at Sari-sou, Sepetdje, Gheikli, and Menlou, on payment of five pias to the Administration of Mines—the cost of a permit. The mines of Sari-sou are situated at a distance of about seventeen miles to the east of Eskichehir. The pit at Sari-sou was opened twenty years ago, but to-day there are 8000 mines opened, of which, however, only 2000 are worked, the remainder having been abandoned. Some 4000 miners work these mines, and every Friday a market is held at which they dispose of the blocks of meerschaum they have extracted during the week. For the accommodation of the workmen some 1000 huts have been erected.

At Sepetdje, about eighteen miles to the northeast of Eskichehir, there are some 20,000 pits in a space of six miles, of which only 150 are worked, all the others being exhausted. It is said that these mines were opened 1000 years ago, which is not incredible, as it is well known that magnesia was formerly used for many purposes, other than the fabrication of pipes; moreover, fuller's earth used to be worked on a vast scale by the ancients. The meerschaum mines are worked by some 500 miners, who live in the surrounding villages. At Gheikli, in the neighborhood of Sepetdje, there are 3000 pits, of which only 100 are worked, giving employment of 400 miners.

The only place where the Administration of Mines authorized meerschaum to be extracted is Menlou, and here there are only twenty pits actually worked by 100 workmen. The working of these meerschaum deposits, called the Eskichehir, mines which formerly were actively worked, is reduced to 1770 pits, giving employment to some 5000 miners, the greater proportion of whom are Kurds and Persians. These deposits are worked on the following primitive systems: A foreman or ganger, having from two to fifteen men under his supervision, having pegged out a piece of ground, generally a meter wide, a pit is sunk until a red, clayey earth, which is the first sign of the existence of magnesia, is reached. Sometimes this is reached at a few meters from the surface, but as a rule the miners have to dig down some 20 meters, and often 40 and even up to 60 meters, before reaching the red earth, wherein the meerschaum is disseminated in kidney and other irregular forms. The volume of these blocks seldom exceeds 30 to 40 cubic centimeters, the greater part of them being the size of a walnut, or an apple. On reaching the gangue containing the blocks of magnesia, the miners drive horizontal shafts through the red clay. This, however, is no easy matter, as they cannot detach or pick off more than 50 grammes of the clay at a stroke. Some of these galleries are no less than a quarter of a mile in length, and it sometimes happens that owing to these being pierced at random different gangs meet underground. They work night and day, the galleries being lighted with petroleum. After a certain quantity of blocks have been extracted, the meerschaum still enveloped in its gangue is drawn out of the pit, and stacked in the miners' barracks. These blocks are bought by the manufacturers of Eskichehir in job lots every Friday, and there are some 150 persons who regularly attend these markets. The meerschaum is then taken to Eskichehir, where the blocks are cleaned, the operation consisting of scraping and cutting the blocks with a sharp instrument or knife, the meerschaum being still soft and easily cut into any shape or form. Over 1100 persons are occupied in cleaning and shaping these blocks, which, after being thoroughly cleaned, are separated into four classes, according to size and quality. These blocks being ready for sale, a bargain is struck between the pipe manufacturers and the commission agents and merchants at Eskichehir, of whom there are about a dozen. The latter then pack the blocks of these four classes with very great care into boxes of equal size, each block being wrapped in cotton to avoid any friction or shock between the pieces. The actual annual output of these mines varies from 120 to 150 tons. The Eskichehir meerschaum is very highly prized in Europe on account of its superior quality, and these deposits, notwithstanding that they have been worked for centuries, are still considered to be inexhaustible.

SHAPIRA THE PHILOLOGICAL FORGER.

The recently published biography of Sir Walter Besant contains an interesting anecdote of Shapira, who may well be regarded as the prince of philological impostors. Shapira was a Polish Jew, who had been converted to Christianity but not to Christian honesty. Many years ago he visited Sir Walter Besant and submitted to him a document which he said refuted every theory held by modern theological students. Shapira was a good actor. At first he would tell nothing of the discovery. Then, after much hard pressing he confided to Sir Walter with apparent reluctance that the document was nothing less than a contemporary copy of the book of Deuteronomy written on parchment. Hesitatingly Shapira exhibited a piece of his precious manuscript. It was written in the Phœnician characters of the Moabite Stone in fine, black ink and was still bright and legible after three thousand years.

Shapira fabled interestingly of his wonderful find. He told how the manuscript had been preserved because it had been deposited in a perfectly dry cave in Moab. Besant urged him to proclaim his discovery to the world. Shapira hesitated; but finally he consented to reveal his discovery to two persons, Dr. Ginsburg, the great Hebrew scholar, and Captain Conder, the Surveyor of Western Palestine. Mr. Besant invited both these gentlemen to visit him on the following day. Dr. Ginsburg thought that the invitation included his friends and brought with him practically the whole British Museum and all the Hebrew scholars in London. Conder also came. Amid much ill-suppressed excitement, Shapira unfolded his manuscript. One of the company remarked that the parchment was strangely modern in appearance and that it spoke well for the art of the time of Moses. When the company separated, a professor of Hebrew remarked, "This is one of the few things that could not be a forgery and a fraud."

William Simpson, of the Illustrated London News, had no great respect for the wily Shapira. Conder quietly observed that "all the points objected to by German critics have vanished in this new and epoch-making trouvaille. The geography is not confused, and Moses does not record his own death." Simpson, who knew all the caves of Moab, and also knew that they were damp and earthy, said, "There is not a dry cave in the country." "Then you think?" questioned Besant. "Precisely," said Simpson.

While the learned professors were hanging over the manuscript for days, and were preparing commentaries, Clement Ganneau came over from Paris to see the document. "I know," he said, "how this manuscript was obtained. The parchment is cut from the margins of Hebrew manuscripts, some of them of considerable antiquity. The writing is that of yesterday."

Ganneau's statement was only too true. Shapira received the manuscript without a single offer to buy it. His mind became unbalanced. His failure and the work of preparing his admirable forgery proved too much for him. He hanged himself.

Peary Relief Expedition.

On the afternoon of July 14 the Peary Arctic Club's relief ship "Windward" sailed for the Arctic regions to bring back Lieut. Peary. The "Windward" took on provisions to last her for a year.

A LONG-TAILED BREED OF JAPANESE FOWLS.

BY WALTER L. BEASLEY.

The first specimen of the remarkable long-tailed breed of fowls from Japan to be seen in this country was recently received at the American Museum of Natural History. The magnificent tail feathers of this creature measure nearly 12 feet, and are strikingly set forth in comparison with the 6-foot figure shown in accompanying illustration. Mr. John Rowley, the taxidermist of the institution, will mount the new acquisition in a characteristic attitude, after which it will be installed in Bird Hall, where it will form one of the most interesting exhibits of that department. Prof. Bashford, Dean of Columbia University, last year visited the locality of the long-tailed fowls and had one grown for the Museum.

A LONG-TAILED JAPANESE HEN.

The introduction of the breed is said to have been brought about by a prince of Japan, whose imperial crest was a feather. Yearly he offered a prize to the subject who would bring to him the longest feather. The greatest effort and skill were therefore employed by the breeders to produce the greatest length of tail feathers possible. At present only a few old fanciers know the secret process of successfully breeding these fowls. A few authentic details have, however, been obtained in regard to the method of their breeding. The particular breed is confined to the region in and around Kochi, the capital of a province of Tasso. The breed is about a hundred years old and is fast dying out. There is said to be no artificial method of making the feathers grow. All is done by selection. Moreover one must know how to treat the birds during the various stages of tail growth. The body feathers springing from the shoulders attain a length of four feet. Two years is the time necessary to produce a full growth of tail. The tail feathers grow from four to seven inches a month, and continue to increase as long as the bird lives, which is usually from eight to ten years. The hens lay about thirty eggs in the spring and autumn, which are hatched by other fowl. The hens are kept housed up and sit all day on a flat perch, and are taken out only once in two days and allowed to walk half an hour or so, a man holding up the tails to prevent them from being torn or soiled. The birds are fed on unhulled rice and greens, and secret food known and prepared by the old fanciers themselves. They demand plenty of water and are wonderfully tame. The ordinary number of long-tail feathers possessed by each bird is fifteen or sixteen. About twice a month they are carefully washed in warm water, and afterward dried on some high place, usually a roof. The present price is $50 for a bird having a tail over 10 feet long. There are four varieties of the breed: White head and body feathers and tail black; second, white all over with yellow legs; third, red neck and body feathers; fourth, reddish color mixed with white on body. All these, with the exception of the second variety, have black tail feathers.

SALVAGE OF THE SCHOONER "MINNIE A. CAINE."

BY JAMES G. M'CURDY.

During the fierce gale that swept over the Puget Sound region Christmas Day, 1901, the four-masted wooden schooner "Minnie A. Caine" was cut loose by the tug that was endeavoring to tow her from Victoria, B. C., to Chemanius. Left to herself, and having every stitch of canvas blown away, during the night the vessel was driven ashore upon the rocky beach at Smith Island, lying at the eastern extremity of the Strait of Juan de Fuca.

The schooner struck at extreme high tide, and being light, she ran far up on the level beach. When morning dawned the craft was high and dry and those aboard had simply to descend the ship's ladder to the beach, where they were hospitably received by the government light-house keeper.

The "Caine" was a new vessel of 780 tons, and the insurance companies and uninsured owners were loath to regard her as a total loss. Although the vessel was not badly injured, the long distance she would have to be moved over the rock-strewn beach, and her exposure to the full sweep of fierce westerly winds, made the question of her salvage a very difficult one. The bids offered for her release were all considered too high, and in consequence those interested determined to attempt to float the craft themselves.

Operations were commenced in February, 1902, the plan of salvage being to raise the vessel above the level of the beach and force her seaward along a track of heavy timbers or "skids," by the use of hydraulic jack-screws.

A gang of laborers was put at work clearing away the sand from the schooner' hull, while heavy timbers, hydraulic jacks, blocks, tackle and other wrecking paraphernalia were brought to the scene. A cook house and lodgings for the workmen had to be constructed, and all the fresh water used had to be brought from Port Townsend on scows, a distance of 14 miles. The isolated position of the wreck added not a little to the difficulties of the task in hand.

As soon as the sand had been sufficiently removed, supports for the jacks were built up of blocking. Cleats nailed to the vessel's hull sustained the upward lift of the hydraulic screws. When the schooner had been raised some distance from her sandy bed, it was found that the sharp bowlders had cut through the hull in several places, and that the keel was splintered and broken.

The holes were covered over with planking and rows of heavy timbers were placed beneath the keel. Then the bowlders lying to seaward were shattered by dynamite and removed, and the skidding continued for a considerable distance down the beach. By careful manipulation of the jacks, the vessel was shoved seaward about 45 feet along the improvised ways. In order to take advantage of low tides, all work had to be done at night.

Thus far the weather had been favorable, but now, when a few days more would have seen the schooner afloat, a gale sprang up from the westward, and in a few hours the heavy sea had destroyed all that weeks of weary work had accomplished.

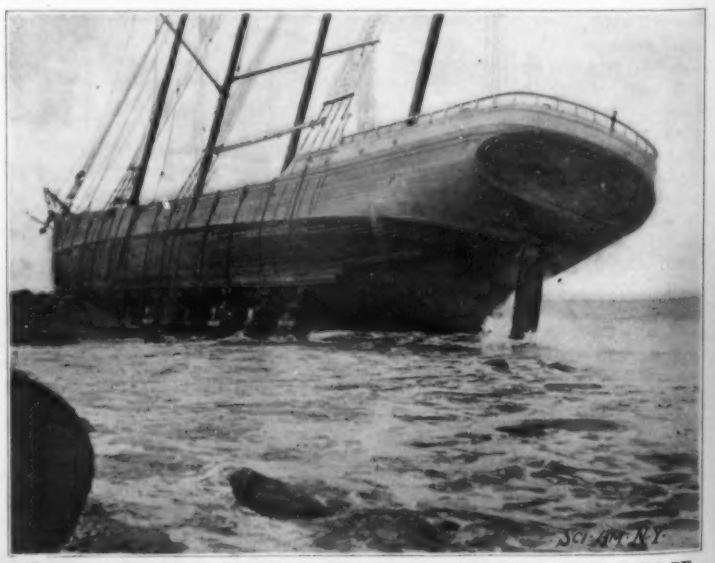
The skidding was washed out and the vessel was thrown back upon the beach. Then came a period of about six weeks when the tides were not low enough to permit of any work being done.

In April operations were resumed. Ebb tide now occurred in the daytime, allowing the work to be carried on much more expeditiously. The skidding was replaced, the jacks were put into position and soon the ship was got moving down the pathway toward the sea for the second time. Before long, however, another violent wind came on and the timber work was again torn out; but the vessel was held to her new position by the use of heavy anchors.

During the ebb tide men were kept shoveling sand from about her hull, while at the flood the winches aboard the schooner were kept straining at the wire cables made fast to the anchors planted to seaward. A tug-boat was called and took several pulls at the stranded vessel, but could not budge her.

Two powerful tugs were next engaged to be on hand May 10 to take advantage of one of the highest tides of the year and make a supreme effort toward floating the craft. Meanwhile the winches were kept going constantly, fighting for every inch of cable that the four-fold purchase would yield.

Finally, on the evening of May 9, the steady pressure told, and the "Caine" slid back into her native element, after being a prisoner for nearly five months. One of the waiting tugs took her in tow and hurried her to Moran's drydock at Seattle, where she will receive a complete overhauling. The salvage operations cost in round numbers $20,000 and the repair bill will amount to at least $10,000 more. But as the vessel had cost $65,000 the year before, her owners were well satisfied with the outcome of their efforts.

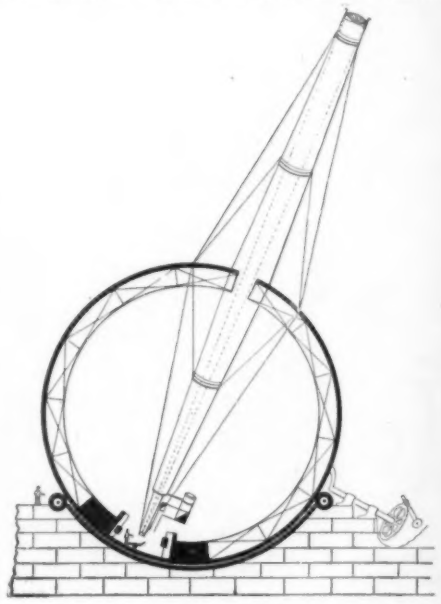


WRECKED SCHOONER "CAINE;" SHOWING LINE OF HYDRAULIC JACKS BY WHICH SHE WAS LIFTED FOR INSERTING LAUNCHING WAYS.

PLANS FOR A GREAT TELESCOPE.

BY MARY PROCTOR.

Prof. Todd, of Amherst College Observatory, has devised an ingenious plan for constructing a telescope, on the model of a gigantic eye, 100 feet in diameter,



PROF. TODD'S PLAN FOR A TELESCOPE.

with a pupil represented by an object-glass 5 feet wide. A tube 200 feet in length, occupying the position shown in the illustration, is designed to extend 100 feet beyond the exterior of the sphere. The focus of the telescope falls on the interior of the sphere, at the point where the retina of the eye is located, and here the eye-pieces, spectroscopes, and photographic cameras are to be placed under the control of the observer. The entire sphere is to be floated in a zonal basin constructed within brick or stone masonry, about 25 feet in depth and from 100 to 120 feet square. By this means the utmost ease of motion may be acquired in directing the sphere.

In order that the observer may enter the sphere, the tube must be placed in a nearly horizontal position, the observer entering through a door in the tube, at a point close to the sphere itself. He then walks along a pathway leading to the adjustable platform, where the eye-pieces and other accessories are stationed. This platform is delicately poised by means of weights which are so adjusted, that if additional

observers are admitted on the platform, their equivalent weight must first be removed before observations begin. This swinging platform may be compared to the glass crystal of a ship's chronometer, being mounted in the same way, always maintaining a horizontal position, no matter in what direction the axis of the telescope is pointed.

From this platform, and extending through an opening in the sphere, is an electrical cable controlling an exterior automatic apparatus, by means of which the telescope may be pointed in the necessary direction for altitude, azimuth, in declination or right ascension. These specified motions may be obtained by means of a series of rubber-faced wheels, mounted on oscillating forks or levers, three wheels being necessary for each co-ordinate, and the required speed being controlled by electric motors. The cable connection inside the platform enables the observer to use any set of co-ordinates he may need, it being possible, of course, only to use one set at a time.

Following the design of the antique armilary sphere, a series of automatic-setting devices for the horizon and equinoctial system of co-ordinates is advisable, these setting-systems being gimbal-mounted and controlled by means of a pendulum. In order that the eye-piece of the finder of the telescope may be as close to the eye-piece of the great tube as possible, Prof. Todd considers a finder with a duplex Coudé tube essential.

With regard to the clockwork required for controlling the moving parts of the telescope, such as the dome and observing platform, exceptional power is needed. Prof. Todd suggests that the mechanism should consist of electric motors controlled by the observer from his chair, thus making a change of level in the floor or the observer's chair unnecessary. In the present style of mounting, the dome is separate from the rest of the structure, and means must be provided for rotating it in the required direction, while Prof. Todd's suggested form of mounting a telescope, either refractor or reflector, is one in which the telescope, observing-floor and dome, are all combined in one.

When not in use the exterior tube of the telescope is lowered nearly level with the ground, and the objective is sheltered beneath a movable roof, like that of a transit-room. In this way, the objective is accessible at any time for the purpose of adjustment or repairs. If such a telescope were placed on a high mountain, it would be possible to keep the interior of the sphere at a comfortable temperature by means of electric heaters, and within a compartment of the sphere, a barometric pressure might be maintained by artificial means.

Prof. Todd estimates the price of such a telescope, as follows:

Sphere	$175,000
Five-foot objective	75,000
Masonry and cement basin	5,000
Clock work and motion	10,000
Tubes and eye-piece accessories	10,000
Total	$275,000

Prof. Todd is well known for his mechanical ingenuity, and has worked out the detail of his scheme very thoroughly, having had it in mind for the past twenty-five years. He had received much encouragement from expert engineers and telescope builders with regard to the efficiency of his plan.

Great telescopes have helped astronomers to make important discoveries, such as that of the planet Uranus, first seen in Herschel's reflector; the satellites of Mars, discovered by Asaph Hall in 1877, with the Washington 26-inch refractor; and the fifth satellite of Jupiter, first glimpsed with the 36-inch Lick Observatory telescope. At the time of these discoveries, these great telescopes made such celestial finds possible. What may not be the result awaiting such a telescope as Prof. Todd has planned?

TONGUE-TRACTION FOR RESUSCITATION OF THE ASPHYXIATED.

It has long been known that rhythmical traction of the tongue is one of the most efficient means for the resuscitation of persons who have been drowned. Dr. Laborde, of Paris, who has carried on extensive investigations on the effect of tongue traction as a means of resuscitation, maintains that often, although the organism has apparently ceased to live externally, it still lives internally. That is to say, life is still latent; and as long as there is latent life, there is still hope of saving an asphyxiated or drowned person. The function which it is most necessary to revive is the respiratory. Experimenting upon dogs, Dr. Laborde found that two or three hours after apparent death had set in, it was sometimes possible to secure resuscitation. A vigorous half bull dog weighing 35 pounds was chloroformed to such an extent that respiration had entirely ceased; after a quarter of an hour's traction of the tongue, the animal came to. The experiment was tried again until complete asphyxiation occurred, and traction was not resorted to until five minutes after. The dog, who bears the appropriate name of Lazarus, this time appeared to be really dead. One hour and two hours of traction were followed by no result. But after another one-half hour, a respiratory cough showed that life was still present. The dog soon revived. It occurred to Dr. Laborde that it would be a good idea to substitute an automatic apparatus for the cloth-covered hand. The first apparatus made was driven by clockwork. The more improved apparatus now used is operated by means of an electric motor, the current being supplied by a secondary battery. By means of this improved instrument it is possible to subject the tongue to continuous traction for three hours.

TONGUE-TRACTION BY HAND.

TONGUE-TRACTION BY THE LABORDE ELECTRIC APPARATUS.

THE MILITIA AND THE COLT AUTOMATIC GUN.

BY G. E. STONEBRIDGE.

After a practice march of seven days over the roads of Long Island, the 3d Battery of the New York National Guard arrived on the eighth day at the rifle grounds at Creedmoor, and used their guns with results that left no doubt as to what would happen if the fire were directed toward an advancing enemy. This battery was formerly armed with Gatling guns, but has now been supplied with the Colt automatic rifle, one of the most deadly machines in existence. The gun weighs only 40 pounds, and the battery is provided with mounts of three kinds, so that it is only the work of a few seconds to transfer a gun from a disabled mount to a good one. One mount is on the carriage, one on the limber, and a tripod, that can be spread and set up in a few moments in any desired location, composes the third. The battery has six carriages and caissons, and six extra guns and tripods, making twelve guns in all with eighteen mounts.

On the range at Creedmoor the battery first went into position at 200 yards and moved back by easy stages until the limit of the range was reached at 1200 yards. The cartridges, on a canvas belt, pass into the gun on the left side, and the empty belt emerges on the right side, while the shells are drawn back and ejected through an aperture near the top. On the under side of the barrel, about six inches from the muzzle, is the gas check, the automaton that does all the work. At each shot the explosion throws this lever downward, swinging it back against the gun. It is this motion that works the interior mechanism which loads, fires and ejects the shell. Eight shots per second, or nearly 500 per minute, is the usual performance of this gun. When a battery of these destroyers is viciously pouring out its rain of destruction, no living thing can stay in its arc of fire. The 3d Battery uses a .30 caliber gun, and smokeless powder. While the stream of bullets is pouring from the muzzle a faint vapor can be seen, but it vanishes the moment firing ceases, and the location of the gun cannot be detected by smoke.

The weapon is made ready for firing by throwing down the gas lever, this action bringing the first cartridge into position. The first shot is then fired by pulling the trigger. The firing then continues until the ammunition is exhausted. The belts of cartridges are folded in layers in a small box, which is hung on the side of the gun, and which feeds unceasingly until no more remain. The empty belts, when rolled up, look like a common lamp wick and can be placed in a coat pocket. The loading tool is quite as ingenious as the gun and resembles a hand sewing-machine. One man feeds the machine with cartridges, a second turns a crank, while a third guides the loaded belt into the boxes. This little machine sews the loaded shells into the belts as fast

Five Hundred Shots per Minute with Smokeless Powder.

Charging the Belts.

A Gun in Action, Using Smokeless Powder.

THE MILITIA AND THE COLT AUTOMATIC GUN.

as a man can feed it. A full service belt holds 500 shells, but for target practice smaller sizes are used. Firing can be stopped at any desired point on the belt by removing one of the cartridges. Thus, in order to shoot five shots continuously, and then stop, every sixth cartridge is removed. The gunners are so expert that each can fire a single shot, which was done repeatedly.

An Improvement in Casting Steel.

In the present practice of casting steel ingots, atmospheric air and the moisture which it contains percolate through the defective joint of the mold, the base upon which the mold stands, the lower superheated portion of the mold, and finally through the fluid steel, rendering it plastic. The fluid steel is oxidized by the column of air upon which it rests. The oxidized particles, having greater specific gravity than the rest of the mass, are precipitated, come in contact with carbon and form carbon-monoxide gas. It is needless to say that the oxygen of the steam passing upward has the same effect.

The nitrogen of the air in passing upward forms a mechanical mixture with the steel and is retained, while the hydrogen combines chemically with a portion of the nitrogen to form ammonia gas. When it is considered that atmospheric air is composed of four-fifths nitrogen, it is evident that the amount of free nitrogen which is taken up by the steel must be considerable, especially so in large ingots. Metallurgists have long known that the effect of nitrogen is to make the steel brittle and hard. For that reason it is considered injurious. While the steel in the mold is still fluid the gases mentioned escape, so that they can do no harm. But as soon as a crust is formed they are imprisoned and form blow-holes. After partial solidification has set in, the column of atmospheric air resting upon the partially-cooled ingot begins to find its way downward through the superheated inner side of the mold, and thence passes into the still plastic steel. Thus the formation of honeycombed steel may be accounted for.

From this brief outline of the usual method of casting steel it follows that the chief difficulties to be contended with are the production of blowholes and honeycomb-like cells filled with carbon-monoxide and ammonia gas. The steel is furthermore charged with nitrogen. The molecular spaces are filled with injurious gases so that the steel cannot be readily welded.

A Newark inventor, Mr. A. J. Lustig, has patented a process in which it is sought to overcome the difficulties mentioned. In this process hydrocarbon gas or vapor is stored around and under the covered mold. As soon as the filling of the mold begins, the superheated hydrocarbon vapors enter, thus displacing the atmospheric air. The carbon or hydrocarbon is taken up by the steel independently of the freed hydrogen. After the mold is filled it is covered, and the hydrocarbon vapors are caused to pass through the steel in order to force outwardly whatever atmospheric air has entered.

It is claimed for this process that no blowholes and no honeycombs are formed. Consequently no injurious gases can be retained in the molecular spaces. It therefore follows that the steel can be welded easily after the first compression of the glowing ingot, either by rolling or hammering. From tests which have been made it would seem that there is an increase in the merchantable quantity of steel obtained of 15 to 40 per cent. The tensile strength of steel made by this improved process is 145,000 pounds in contradistinction to 125,000 pounds at present obtained. The elongation of the new steel is 4.60; that of the old 1.09. The area of reduction of the new steel is said to be about 2; that of the steel at present made is practically nil. The chief merit of the new steel, however, is to be found in the fact that it is most readily weldable.

Amazon Rubber.

The greater part of the world's supply of rubber comes from the jungles of the Amazon. The growing demand for the product has led the natives to explore regions which have hitherto never been trodden by man. These explorations have resulted in the discovery of new areas of rubber lands. Consequently the world's supply of rubber annually exported is increasing. The shipments from Iquitos during 1900 amounted to 930 tons; in 1901 the quantity sent abroad increased to 1391 tons, and this year a still larger gain is expected.

Marconi's Latest Feat.

News comes from England that Marconi, while at Cronstadt, Russia, succeeded in receiving wireless signals from the Cornwall station. The distance was about fourteen hundred miles, and the signals were transmitted partly overland and partly over water. Messages were received as far as Skagen, Denmark, about eight hundred and fifty miles from the Cornwall station.

Correspondence.

Volcanoes and the Sun and Moon.

To the Editor of the Scientific American:

Referring to your comments on my communication about "Volcanoes and the Sun and Moon," published on June 21, you have apparently misunderstood my theory, as I do not maintain that volcanic and seismic action should be greatest where the tide is highest and least where it is lowest. The abnormally high tide in the Bay of Fundy is evidently caused by the "contour of the continents," as you state, for the moon's attraction is of course no greater at the Bay of Fundy than elsewhere in the same latitude, and therefore volcanic and seismic action is not expected to be greatest there.

The influence of the moon and planets in causing and intensifying seismic and volcanic disturbances is not altogether tidal action—gravitational; it is partly, or mostly, electrical, and seismic and volcanic action is an electrical disturbance. This is the reason why sultry weather, which always accompanies thunderstorms, also goes with volcanic eruptions and often with earthquakes. Hence, sultry weather is popularly called "earthquake weather," and in the Hawaiian Islands it is known as "volcano weather." It is a remarkable fact that "when Mont Pelée blew up, magnetic needles two and three thousand miles away quivered on their pivots."

The effect of the moon's crossing the earth's equator is electrical disturbance, not at all gravitational, and a little observation and reading of the daily papers will prove that electrical storms, and in fact severe storms of all kinds, are more frequent at about the time of the moon's equatorial passage than at any other time. In proof of this, note the terrific storms that occurred about May 3, 16, 31 and June 13 and 27, even in this country alone, and also notice what occurs on and touching the following moon-on-the-equator dates the rest of this year: July 10, 24; August 6, 21; September 3, 17, 30; October 15, 27; November 11, 23; December 8, 21. Some interesting experiments by Prof. Elmer Gates on "The Electrical Causes of Changes in the Weather" were described in the Scientific American of August 10, 1901.

I cannot agree with you that a relation must be established between planetary positions and "moments of volcanic outbreaks or severe earthquakes," for the planetary cause is not the sole cause (as it is with tides); in some cases where a volcano is almost strong enough to burst forth of its own accord, the planetary influence is strong enough to precipitate the outbreak a good many hours, or perhaps a whole day, before the actual moment of the conjunction, perigee, etc.; the planetary influence comes on gradually and is cumulative, my observations indicating that volcanic and seismic disturbances are more likely to occur shortly after rather than before, or at the moment of, the planetary positions.

Following are some more "coincidences:"

The volcano of Kilauea, in the Hawaiian Islands, began eruption on July 4, 1901—the day before the opposition of Saturn—and continued through the moon's equatorial passage on the 6th, perigee on the 11th, and new on the 15th, ceasing about 30 hours after the moon crossed the equator again on July 19.

An Associated Press dispatch of April 17 stated that Albrim, Lopevie and Tingoa volcanoes, in the New Hebrides Islands, were in eruption on March 10—another moon-on-the-equator date.

In Alaska, Mount Blackburn erupted on April 11—the next day after perigee—and Mount Redoubt on May 3—the same day that Mont Pelée began eruption—caused by the moon on the equator.

A dispatch states that the seismographs of W. A. Eddy, the Bayonne (N. J.) seismologist, recorded earth tremors from the east-southeast on the night of May 15-16, leading him to predict new eruptions in the West Indies, and that "this is the first motion of the seismograph needles since March 22." On referring to my almanac I find: moon on equator May 16 and March 23; also full 23d; perigee and equinox, 21st.

Some coincidences omitted from my first letter were the perihelion of Mercury on May 4, with the first eruption of La Soufrière next day, and the occultation (direct conjunction) of Mars by the moon on May 7, when that volcano was at its worst.

The predictions in my communication of May 18 were verified by the eruption of Mont Pelée on May 30, earthquakes in Hawaii on May 31, two eruptions of Kilauea June 1, a "violent outburst" of Mont Pelée June 6, and again on the night of June 13-14.

If scientists will not admit any influence of planetary conditions in causing seismic and volcanic disturbances, they must then account for simultaneous disturbances of this kind in different parts of the world by supposing that distant volcanoes are connected, and that, therefore, a large part of the interior of the earth is molten matter—which they cannot deny must be subject to the same gravitational influence that causes the tides. Elmer G. Still.

Livermore, Cal., June 29, 1902.

The Largest Watch in the World.

At the American Waltham watch factory, the largest watch ever designed was recently completed. To build this gigantic timepiece cost several thousand dollars and several weeks' time. Special machinery and tools were required for its construction. The watch is a model of the new model 16-size Maximus, three-quarter plate watch, enlarged ten times, perfect in every detail and as highly finished as the finest watch.

The diameter of the pillar plate is 17 inches, and the movement is 2½ inches thick. The balance wheel is 6½ inches in diameter, and the Breguet spring which controls its action is 8 feet long, 0.08 centimeter thick and 0.25 centimeter wide. When running the balance makes a vibration in 0.7 second. The pallet stones are of sapphire and exquisitely polished. The actuating, or mainspring, is 23 feet long, 0.17 centimeters thick and 2.9 centimeters wide.

The mammoth model is as completely jeweled as a watch of the finest grade. The plate jewels, which are as large as the smallest movement made, or about the size of a nickel five-cent piece, are fine rubies, about ten lines in diameter, but bushed with sapphires. The polish of the wheels, pinions and other steel work is perfect, and the damaskeening on the plates is most beautiful. The pendant and winding crown are of fine bronze, brilliantly polished. Every portion is made on the exact scale of the watch it represents. No dial has been made for this movement, as it is designed to show not only the action of the train, but the stem-winding and stem-setting mechanism as well.

The movement stands on a bronze pedestal and from its base to the tip of the winding crown is twenty-six inches.

Precautions Against Electrolysis of Gas Pipes.

How important it is for a city to adopt some measure for the prevention of the destruction of its gas and water pipes by electrolysis is shown in the recent suit of the city of Dayton, O., against a local trolley company. With the example of Dayton before it, the city of Baltimore has decided to take the necessary steps to forestall a destruction of its pipes. An agreement made with the trolley company of that city provides that the city is to receive $500 annually from the railway company for the privilege of running a copper wire nearly two inches thick through the municipal subways. It is expected that this wire will take up the surplus current which has been escaping into the ground and eating up the pipes, and send it back to the power house, thereby giving the company more power and giving relief to the water and gas companies. It will cost the railway company about $20,000 to lay and bury the wire, and if the calculations are correct the gain will be enormous, as it is expected to save a large amount of electricity. Whether it will work well in practice and overcome the great damage done by electrolysis remains to be seen. Those interested in the plan, however, profess to have great confidence in it.

The Current Supplement.

The deplorable artistic disaster which Italy has sustained in the fall of the historic Campanile of St. Mark's is made the subject of the opening article of the current Supplement. The famous old tower is pictured, as well as the celebrated Loggetta of Sansovino, with its splendid gates. Of technological interest are a discussion of mechanical standardization in Great Britain; an article on the manufacture of india rubber; and a review of alloys. From the scientific standpoint perhaps the most important feature of the current Supplement is the paper which Mr. Marconi recently read before the Royal Institution on the "Progress of Electric Space Telegraphy." The noteworthy Pittsburg meeting of the American Association for the Advancement of Science is fittingly commemorated by the publication of a résumé of some of the more important papers read. In addition to this résumé Mr. B. T. Galloway's vice-presidential address on "Applied Botany, Retrospective and Prospective," is published in full. Among the minor articles of interest that deserve mention are those on the Porro Prism Field Glass; the Virtue of the Pineapple; French Mortars; and the Gannets of the Bass. It may not be known to many that the man who invented the gelatine dry-plate died a few weeks ago in England. In memory of the services which Dr. Leach Maddox performed for photography an article has been published on the man and on his invention, which is appropriately accompanied by a picture.

Builders' Trial of the Battleship "Maine."

The speed record for American battleships was broken by the "Maine," recently completed at Cramps' shipyard. For thirty minutes she ran at a speed of 18.95 knots per hour, while her average speed for an hour was 18.29 knots. For a run of 30 knots an average of 18.08 knots per hour was made.

MAKING THE CABLES ON THE NEW EAST RIVER BRIDGE, NEW YORK.

We have described from time to time, in the columns of the SCIENTIFIC AMERICAN, the four great cables which will support the massive 188-foot roadway of the new East River Bridge, and in a recent article we gave photographs showing the temporary footbridges which have been used in stringing the cables. The last of the strands has now been completed, and the four cables hung in the positions which they will permanently occupy. It would be well, therefore, before describing in detail the method of building to recapitulate some of the dimensions of these, the largest suspension cables in the world. Each cable is 18 inches in diameter and 2985 feet in length from anchorage to anchorage. When the weight of the floor system is upon them, the cables will extend in a fairly straight line from anchorage to saddles at the top of the steel towers, where the center of the cables is 333 feet above mean high water mark in the East River, while the horizontal distance from saddle to saddle across the main span is 1600 feet. The breaking strength of each cable is 25,000 tons and their combined weight is 5000 tons. The actual dead load which they will carry when the bridge is completed is 8000 tons, and they are calculated to carry a maximum moving load of 4500 tons. Each of the four cables contains 10,397 No. 8 steel wires. The specifications called for a strength of 200,000 pounds per square inch, but the actual breaking strength of the wire as determined on test, shows that the cables have an average breaking strength of 225,000 pounds per square inch; a truly marvelous result, and one which places these cables far ahead in point of tensile strength of any other structural material yet used in bridge building.

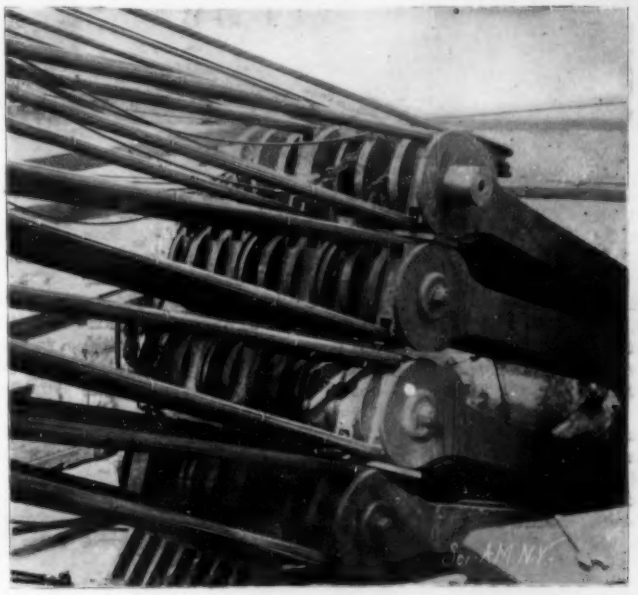
For the construction of the cables, temporary working platforms were built from the anchorages to the top of the towers and between the towers. These platforms were for the accommodation of the workmen in handling and adjusting the wires. The platforms were double-decked, the upper deck being used for the construction of the separate cable strands, which were lowered as they were completed through a distance of 15 feet to the lower platform, where they were assembled in the cable. The cable wires, which are about 3-16 of an inch in diameter, were made at the mills in 4000 foot lengths and reached the site of the bridge on 7-foot wooden reels. Each reel contained 24 of these lengths of wire, which were coupled at the ends with sleeve nuts, the joints being designed to give the full strength of the unbroken wire. The reels of wire were placed on each anchorage in bearings carried on wooden frames, which were laid in the lines of four cables. At each end the cables had to be connected with a series of massive eye-bars, which extend down through the anchorage and are bolted to a huge anchor platform at the base of the masonry. The connection consisted of massive shoes round which the wires of each strand were carried, the shoes being themselves pinned in between the ends of the I-bars, as shown in our illustrations.

The method of building each strand was as follows: The end of a wire was taken from one of the spools and made fast to the strand-shoe, and then the wire was unwound from the reel sufficiently to form a bight, which was passed around a 3-foot sheave, attached to an endless carrier cable which extended from anchorage to anchorage across the towers. The two parts of the carrier-cable were arranged as near as possible to lie in the plane of one of the main cables, and each part had attached to it a carrier sheave, in such a way that while one sheave was carrying its strand wire from New York to Brooklyn, the other was carrying its own strand wire from Brooklyn to New York. It will be evident from what we have said that each time a sheave traveled across the river, it drew with it a double wire. As a similar arrangement was provided for the other two cables, eight wires altogether were being simultaneously carried across the river when the whole system was in operation. When the carrying sheaves reached the opposite anchorage, the bights of the wires were removed from the sheaves and slipped over the strand-shoes. The rate of progress of the work was about 50 wires in each strand in ten hours, or a total of about 400 single wires each working day. When the end of the coil of wire was reached it was placed in a vise opposite to the end of the next coil of wire and the two were connected by a sleeve nut. A perfectly even tension was secured in each wire by adjusting it so that it conformed to the curve of a guide wire, which had been accurately adjusted in position by the engineers.

One of the best features of the new cables is the very excellent system of protection against weather which has been adopted. In the first place the wire is thoroughly coated at the mills with a heavy mixture of graphite and oil, and although its greasy condition rendered it extremely disagreeable to handle, the benefit will be found in the practically indestructible nature of the work.

In putting up the strands, the apportionment of labor was as follows: There were three men on each anchorage to look after the reels, put the bights on and off the carrier-wheel, splice the wires, etc. There were three men to handle the wires at the top of the tower until the strand was ready for lowering into the saddle whose duty it also was to see that the wires were hung exactly in the curve of the guide-wire already referred to. There were also three men placed between the anchorage and the top of the tower, who, as soon as the tension was adjusted, clamped the wire to the strand. The adjustment of the wire between the towers was done by seven men, and the adjustment of the wire between the other tower and the anchorage was accomplished in a similar manner to that described already. Care was taken in placing the bights of the wire around the strand-shoes to lay them in regular courses on the shoe, so that they would correspond with the position of the wires at the other end of the strand on the opposite anchorage.

As each strand was completed, its end shoe was turned from the horizontal to a vertical position and allowed to slide forward toward the tower, thereby lowering the strand to the final position of the finished cable; the shoe being finally placed in position between the anchor chain eye-bars and held in place by its end pin. The thirty-seven strands in each cable are arranged in a hexagonal cross sectional form, five strands lying on each side of the hexagon.



Anchor Bars, Bedded in Masonry of Anchorage, and Used to Fasten Cable-Loops and Ends.

To complete the cables it will next be necessary to place around them the clamping bands, which will form also the saddles in which the suspender cables will rest. Then the cables will be covered with protecting shields which will consist of half-round troughs of sheet steel, semi-circular in cross section, one half of which will lie below, and the other half above the cables. Between them and the cables will be run in a hot mixture of cable preservative similar to that in which the individual wires were soaked as they were manufactured.

The Seventeen-Year Locust.

BY F. H. BLODGETT.

When the seventeen-year locusts first made their appearance in Prince George's County, Maryland, about the 25th of May, I noticed that a number of the mature insects had their beaks perpendicular to the surface of the tree on which they were resting; but knowing that Riley and other entomologists had studied the question of their life-history very thoroughly, the thought that they might be feeding was put aside as untenable until June 5, when they were observed in similar positions in considerable numbers upon young apple trees in one of the college orchards. Some of the trees upon which the locusts were most abundant were wet over considerable areas, and careful observation revealed the fact that the wet areas appeared at places where the cicadas had recently been resting. Close observation was immediately begun, and a number of cicadas were observed with their beaks perpendicular to the surface of the bark. When disturbed, they were observed to withdraw their beaks, and immediately a drop of liquid made its appearance at the spot where the beak had been resting. In order to determine whether the beaks were actually inserted in the bark, and whether the globule of liquid came from the insect or from the tree, beaks of a number of insects were clipped off with scissors, so that they remained sticking in the bark. A piece of the bark was then cut out with the beak still retained, and photographs were taken of the beak in place. In addition to this point, sections of the beak also were made, which showed that the setæ were forced through the outer bark into the cambium layer of young apple and poplar trees to a depth of four millimeters.

On June 18, photographs were made in the field of cicadas feeding, and it was observed that ants and other sweet-loving insects gathered about the feeding cicadas, and when the latter withdrew their beaks, and the resulting liquid appeared on the bark, the ants immediately began to gather about the spot and to feed on the oozing sap. A photograph was secured only after several failures, but the failures gave an opportunity for observing minutely the method of feeding on the part of the cicada. The insect finally photographed had been feeding lower down upon the same trunk, and was disturbed by the motions made in adjusting and focusing the camera, so that it moved away from its then location, and after a time readjusted itself in the one where it was photographed. When moving, the beak is folded back between the forelegs at an angle of about 45 degrees, so that the tip is just free from the surface of the bark. As it begins to feed, the tip of the beak is brought forward, so as to become more nearly perpendicular, and is rested against the bark. The insect then "backs up," so as to bring the upper end of the beak in a perpendicular position above the tip, which is, as already stated, resting against the bark. This backward movement on the part of the insect is accompanied by a setting of the legs in a firm position, and is accompanied by an actual pulling back of the body by the hind legs rather than a mere settling closer to the bark. With the beak now in a perpendicular position, the setæ apparently are protruded through the tube which the beak forms, and this is accompanied by a slight sinking of the head, as the beak itself appears to be forced to a slight degree into the bark. Having thus inserted the sucking apparatus, the cicada drinks its fill, or until disturbed; and its source of supply is so abundant, that when the beak is withdrawn, more or less of liquid follows the withdrawal of the beak and affords an attraction for sap-loving insects. The insect is so intent upon feeding, that with care one can snip off the beak with slender scissors, so that almost its full length will remain in the bark. This is not so easily done, however, as is the snipping off of the ovipositor in place, which, owing to the depth to which it is inserted in the wood, cannot be withdrawn so readily as the slender and flexible beak. The insects seem to be sensitive to sudden motion rather than to near or strange objects in themselves, as difficulty in approaching them was almost entirely obviated when focusing cloth and other swinging or flapping articles were removed. But even when approached successfully, the feeding cicadas were likely to move just at the wrong time, on account of the movements of the camera body.

The feeding habits and the digestive organs of the cicadas are to be treated at some length in a bulletin from the Maryland State Horticultural Department during the present season, in which the observations here recorded will be treated at greater length by the State entomologist, to whom the matter has been referred.

Another New York and Chicago Railroad Record.

Four hundred and eighty-one miles in 460 minutes is the new record made on the Lake Shore and Michigan Southern by the 20th Century Limited Express. When 45 miles west of Buffalo the train was 2 hours and 28 minutes late. The track was cleared, and orders given to make up as much of the lost time as possible. The 124 miles between Brockton and Cleveland were covered in 131 minutes. The distance from Cleveland to Toledo, 113 miles, was made in 103 minutes, the speed on this stretch at one time reaching 90 miles an hour.

The train left Toledo 1 hour and 40 minutes late, making up 40 minutes on the run to Elkhart, a distance of 143 miles, arriving at Chicago 35 minutes late, making the run from Toledo to Chicago, 244 miles, in 228 minutes, including three stops—one at Elkhart, where they changed engines; one at Englewood, and one at Thirty-first Street, making an average speed from Toledo of over 64¼ miles per hour, including stops.

Congress, with the approval of the President of the United States, has provided that the World's Fair at St. Louis in celebration of the Centennial of the Louisiana Purchase, shall be held in 1904.

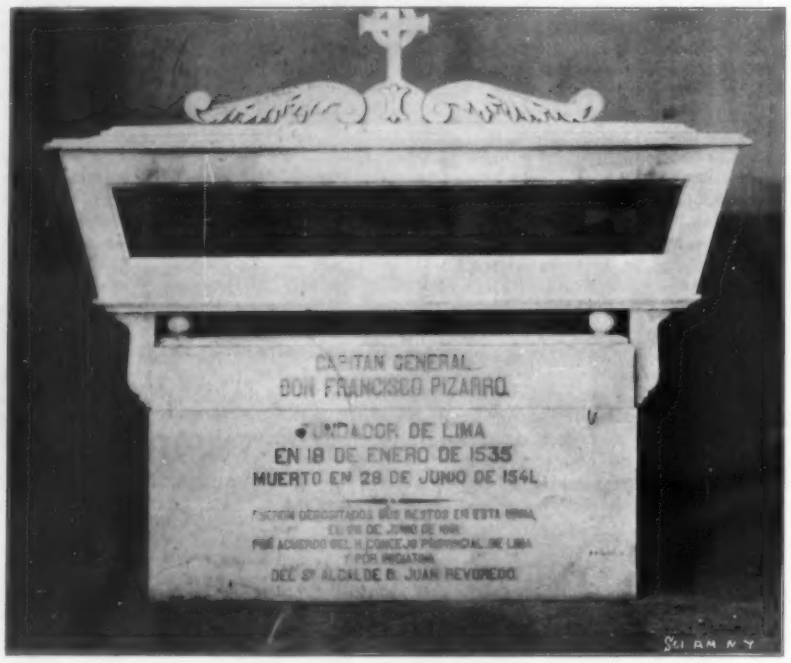
THE REMAINS OF PIZARRO, FOUNDER OF PERU AND CONQUEROR OF THE ANCIENT INCAS.

BY R. C. ROST.

In the famous ancient cathedral of Lima, Peru, are on exhibition the remains of Captain-General Don Francisco Pizarro, who founded Lima January 18, 1535. These remains are contained in a white marble coffin, with a glass front, thus exposing to view the well-preserved remains within. The coffin stands in a niche or more properly a vault, entrance to which is had through a massive iron-barred door. To view these remains one must fall into the good graces of an attendant in the cathedral, who for one sol (fifty cents) opens the iron doors, lights a candle and by this light the remains are examined.

It was my ambition to obtain a photograph of these remains, perhaps of greater historic interest than all else in South America. Pizarro was at once the founder of Lima (if not of South America), conqueror of the ancient and highly-civilized Incas, and may be regarded as one of the most brutal of all warriors. It required some very strong influences to procure the desired permission, and it was only after an appeal to my good friend Emanuel Elguerra, twice secretary to the Peruvian Legation in Washington, that the necessary permission was finally granted.

Owing to the poor light in the vault I was obliged to give the plate two and one-half hours' exposure, with the result herewith shown. Several rolls of parchment manuscript visible near the foot of the body are also contained within the marble coffin, which was placed where it now stands in 1891. Pizarro was killed in the palace at Lima June 26, 1541, and his remains were previously buried in a subterranean vault of the old cathedral.

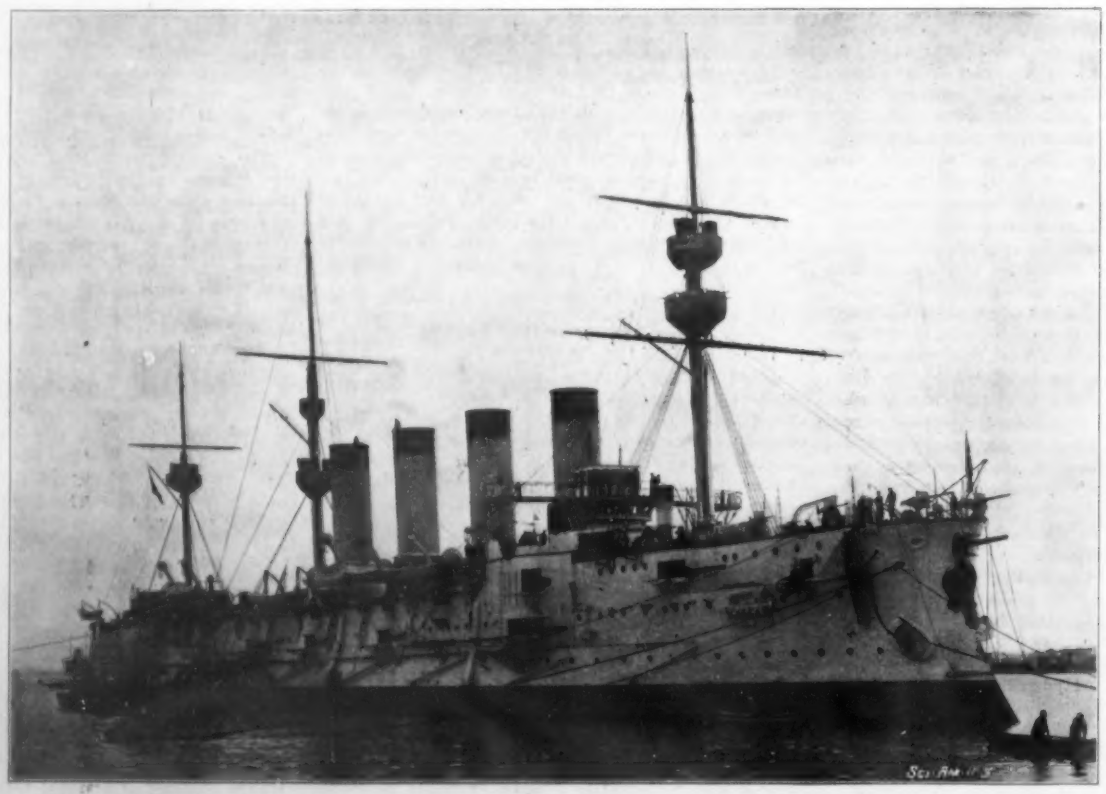


THE REMAINS OF FRANCISCO PIZARRO

THE RUSSIAN ARMORED CRUISER "GROMOBOI."

Russia has always favored the armored cruiser, and she was, indeed, the first navy to put afloat any of those long, fast and powerful armored vessels which have recently become the popular and predominant type among the leading navies of the world. The Scientific American some time ago made its readers familiar with the Russian armored cruisers "Rurik" and "Rossia," which so excited the interest of the British navy that a quick reply to them was made in the "Powerful" and "Terrible." These latter vessels, however, because of their lack of side armor, would be a questionable match for the two small but better-armored Russian ships.

The "Gromoboi" is one of the latest of the Russian armored cruisers, and both in design and appearance is certainly a handsome and formidable-looking fighting ship. She is 473 feet in length, 68 feet 6 inches in beam, her draft is 26 feet, and displacement 12,336 tons. Like our own "Minneapolis" and "Columbia" she is driven by triple screws, her engines of 14,500 horse power serving to give her a speed of 20 knots an hour when everything is pushed to its full capacity. Built at St. Petersburg, and launched in 1899, she may be said to embody the very latest ideas of Russian naval designers as to what goes to make an efficient vessel of her class. She carries, in the first place, a partial belt of 6-inch steel face-hardened by the Harvey process, and her main gun positions are also protected by 6 inches of the same armor. Although the belt is not carried entirely to the bow and stern, it is associated with deck plating 3 inches in thickness, and this, of course, with its turtle-back form, offsets in some measure the undeniable weakness of the unprotected ends. The armament is carried entirely in broadside, with the exception of a bow-chaser and stern-chaser, which fire through casemates on the main deck at the stem and stern. On the upper deck, at the four corners of the central armored citadel, are four 8-inch rapid-fire guns. Forward of these, on the main deck, but outside of the citadel, are three 6-inch rapid-fire guns, one on either bow, and the third as above mentioned, mounted in the bow as a bow-chaser. There is another 6-inch gun on this deck which is mounted, as also mentioned above, as a stern-chaser, a gun port being cut for this purpose on the main deck through the stern. There are also a dozen 6-inch rapid-fire guns mounted in broadside within the citadel on the main deck, six on either broadside. The "Gromoboi" also carries twenty 3-inch rapid-fire guns, while several smaller rapid-fire guns are mounted on the bridges, superstructures and in the fighting tops.



Displacement, 12,336 tons. **Speed,** 20 knots. **Maximum Coal Supply,** 2,500 tons. **Armor:** Belt, 6 inches; gun positions, 6 inches. **Armament:** Four 8-inch; sixteen 6-inch rapid-fire guns; twenty 3-inch rapid-fire guns and several smaller rapid-firers. **Torpedo Tubes,** 5. **Complement,** 750.

RUSSIAN ARMORED CRUISER "GROMOBOI."

The Russians are great believers in the automobile torpedo and, unlike other great naval powers, they continue to mount a large number of these on their modern ships. The "Gromoboi" carries five torpedo tubes, of which one is above the water-line and the other four are submerged, the Russians using a special form of submerged launching tube designed for this purpose. Another characteristic feature of this vessel is her large coal capacity, which is set down in the official list as 2500 tons of coal. This handsome cruiser is designed primarily for service in Chinese waters, and this will account for the very large coal capacity (that is, large in proportion to her displacement) which has been given her. Our photograph was taken when the vessel was on her way out to Chinese waters and preparing to pass through the Suez Canal.

New Type of Submarine.

Particulars are to hand of the new submarine boat invented by Mr. Claude Goubet, which has just been sold to the newly-formed British Submarine Boat Company. It is said to differ very widely from the newest "Holland" type, to which the present British submarines belong. While the latter have a reserve buoyance when submerged, and are kept under by means of horizontal rudders, the Goubet boat possesses no reserve buoyancy when beneath the water, its weight equaling its displacement. The new type, in fact, weighs nothing when submerged, and it is said that the addition of a very small weight will set it sinking. In order to keep the boat on an even keel and prevent its either rising or sinking the inventor has devised an arrangement which pumps water from a forward tank to one situated aft, and *vice versa*. The method of working is described as follows: Should the vessel incline in any direction a pendulum swings forward, and in so doing forms a connection between a motor and the batteries; the former at once commences working the rotary pump in a direction which causes the water to flow through the pipes from the lower tank to the higher, until the addition of water to the latter is sufficient to bring both the boat and tanks level again. The pendulum swinging straight then cuts off the electric current and the motor instantly stops.

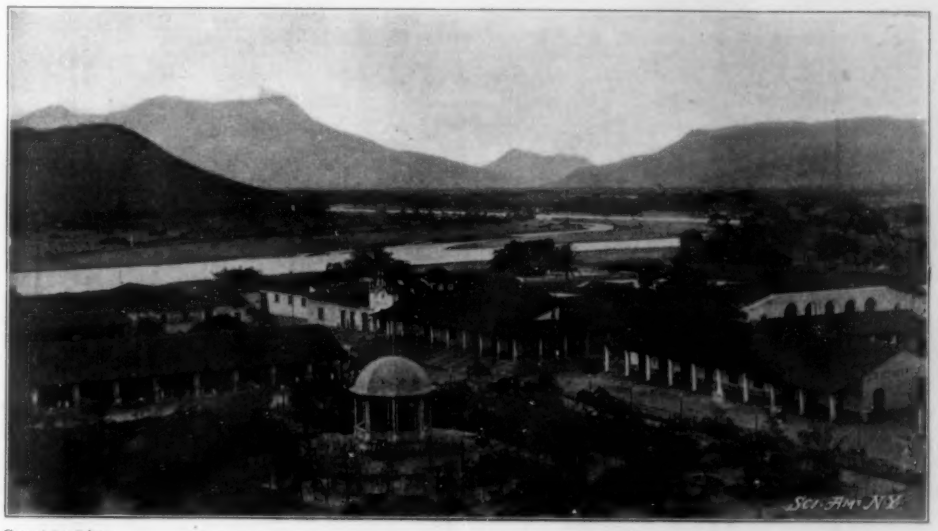
An interesting work of creating a waterfall for the purpose of supplying power is now being carried on at the headwaters of the Little Blackfoot River, about 30 miles west of Helena, Mont. Miles of flumes and ditches are being constructed, by means of which a number of small streams are being brought together and carried five miles to the mouth of Hat Creek over a precipice of 500 feet. Here a power plant will be erected, and it is calculated that there will be 1000 horse power available. The current generated will be transmitted a distance of 10 miles to the Porphyry Dike Mines, at the summit of the main range of the Rocky Mountains, where there is one of the largest deposits of free-milling gold to be found in this country. The work is being done by a syndicate of St. Louis capitalists, and the active work has been in progress for two years and is now rapidly reaching a state of completion.

THE TEHUANTEPEC RAILROAD VS. THE ISTHMIAN CANAL.

BY OUR ENGLISH CORRESPONDENT.

The reorganization of the railroad across the Tehuantepec Isthmus of Mexico, connecting the Atlantic and Pacific seaboards, and the construction of adequate steamship accommodation at both the port terminals is proceeding rapidly. The line will be in thorough working order by May, 1903, in the contracted time. When completed this railroad will offer serious competition to the projected Isthmian Canal.

The necessity of a trade route from Europe to the Far East via Central America has long been considered expedient. When De Lesseps commenced the Panama canal its completion was anxiously anticipated by shipping owners and merchants in Europe as a short, quick route to the Orient. But this scheme has so far resulted in ignominious failure, and exasperating procrastination has ensued in connection with the construction of the Nicaragua canal. Meanwhile the traffic between Europe and the East has developed so abnormally that accelerated communication between the two sides of the world has become imperative in the interests of trade. The situation became so critical that Sir Weetman Pearson, Bart., the well-known London civil engineer and contractor, visited Mexico to discover if railroad connection could be established between the two oceans as a solution of the problem.



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The City of Tehuantepec, through which the Railroad Passes.

The Mexican government some seven years ago constructed a railroad across the Tehuantepec Isthmus connecting the two oceans, and it was known as the Tehuantepec National Railroad. But it was built in the most primitive manner, and proved totally unfit for heavy traffic. But Sir Weetman Pearson immediately realized that this route could be developed and could easily be made to fulfill nearly all the same requirements as a canal. He thereupon approached the Mexican government on benalf of his company, offered to take over the whole of the Tehuantepec railroad, lock, stock and barrel, and to reconstruct it. The Pearson company has completed several great engineering contracts in Mexico, and has done much to increase the welfare and prosperity of the country. This company constructed the harbor at Vera Cruz at a cost of $12,500,000, and has now commenced to carry out a complete modern sanitary system and a water supply at a cost of $2,500,000. This company owns the tramways of the city, which are to be converted to electricity, a railway running to Alvarad, and a fleet of steamers plying upon 400 miles of navigable rivers, and a new railroad has been built from one of the rivers to join the Tehuantepec trunk railroad, by which the interior of the country will be opened up.

In view of these circumstances the Mexican government did not hesitate to enter into an arrangement with the Pearson company regarding the Tehuantepec Railroad. The terms of the agreement are mainly as follows:

The Pearson company to put the railroad by May, 1903, into first-class and permanent working condition, in which it would be capable of handling traffic expeditiously and at low tariff. For the cost of these improvements the Mexican government contributes free of interest $5,000,000 (Mexican money). For the additional rolling stock, working equipment and haulage facilities the Mexican government and the Pearson company provides equal amounts to be called up as required.

The Pearson company undertakes to construct and properly equip at the cost of the government a port at each end of the railroad capable of accommodating the largest ships in all weathers, and of giving quick and cheap dispatch. By May, 1903, the port works both on the Atlantic and Pacific coasts are to be sufficiently completed to enable traffic to be handled with celerity and facility, but the works will not be completely finished until 1905.

A contract of partnership and lease was also drawn up between the Pearson company and the Mexican government, by which the former is to manage the railroads and ports and the drydock for 50 years from May, 1903, and to receive 37½ per cent of the net proceeds for 35 years, diminishing to 26 per cent in the remaining 15 years.

The length of the Tehuantepec Railroad is 192 miles. The whole of the roadbed is being overhauled, leveled where necessary, and re-embanked at sections to afford security, so that when completed the track will be as even and smooth running as that of any railroad in this country. It is a single line track, and it is being relaid throughout with heavier steel rails. The whole of the bridges are being demolished, and modern steel structures built in their stead. This task alone is a stupendous one. Before this renovation there were only six steel bridges throughout the whole 192 miles of the railroad, the bridges being constructed on the timber trestle principle. There were 900 of these trestle bridges, and the whole of these have been swept away and either culverts or steel bridges substituted.

Owing to the possibility of seismic disturbances in this country the bridges are being built principally of steel girders. This is more economical than the

The West Breakwater Crane.

The Coatzacoalcos Crane.

Junction of the Vera Cruz and Pacific Railroad with the Tehuantepec Railroad.

Photographs copyrighted by C. B. Waite.

THE CONSTRUCTION OF THE TEHUANTEPEC RAILROAD.

erection of arch bridges, since in the event of an earthquake a steel bridge will give somewhat, and if seriously disturbed the damage can be quickly repaired, whereas with an arch it will crack and have to be rebuilt. The spans for the most part are of about 85 feet, but in one or two cases they rise to 100 feet span, and in one instance to 110 feet. The girders are supported upon steel caissons sunk into the bed of the river and filled with concrete, thus assuring a solid and rigid foundation. The bridges are of sufficient strength to carry a load of 20 tons per axle.

But the most important part of the undertaking is in connection with the dock facilities and harbor accommodation at the terminal ports—Salina Cruz on the Pacific coast, and Coatzacoalcos on the Atlantic seaboard, respectively.

Coatzacoalcos is a thriving and prosperous town of about 2400 inhabitants. Owing to its exposure to the turbulent storms characteristic of the Atlantic Ocean the harbor works are of the most solid description to insure safe anchorage to vessels. The River Coatzacoalcos is conveniently adapted for extensive wharfing arrangements, the river being very broad at its mouth and having a great depth of water. The river is also navigable for several miles from the sea. The only real engineering difficulty encountered has been in connection with the sand bar extending across the estuary. The contractors, however, are constructing a heavy training wall by which means an open channel will always be maintained. Extensive dredging operations are being carried out whereby the depth of the water alongside the wharves will be made about 35 feet at low water.

At Salina Cruz, owing to the entire absence of natural conditions for protection, a complete harbor is being built. This port is somewhat exposed to the Pacific Ocean, but an adequate idea of the peaceful nature of its situation and the absence of heavy surf may be formed from the fact that the houses of the old town were only five feet above high-water mark.

At this port the harbor works being constructed are very extensive. A breakwater about 3300 feet long is being built, by means of which a large harbor of 90 acres' extent will be formed. Entering from this there will be a dock with over 4000 feet of quay space. In connection with this scheme a new town is being erected a little further removed from the water's edge, since the land upon which the existing town stands will be submerged to form the central basin. This new town is being built upon modern principles, the streets being laid out with regularity, numerous open spaces provided, and a complete up-to-date sanitary system and water supply provided.

The breakwaters are being built upon the telescopic principle. Rubble is thrown overboard and continued to water level, the superstructure consisting of concrete blocks each weighing 40 tons. The material for these blocks is being excavated from the quarries nearby, and consists of tough limestone and granite. The concrete blocks are made by electric mixers, and laid in position by a traveling Titan crane. This latter appliance, which is second only in size to that specially constructed for use at the new naval harbor works at Dover, England, which are being carried out by the Pearson company, cost $50,000. It was specially designed for the construction of the breakwater at Vera Cruz, also completed by this company, and has a jib radius of 95 feet. The concrete blocks are conveyed from the mixing department to the crane in cars.

At the present time the engineers are carrying out trials with three different types of locomotives to ascertain the most economical and best adapted for haulage purposes upon the road. This country is represented by the Baldwin and Pittsburg locomotive companies respectively, and England by Kitson, of Leeds. Three engines from each firm have been supplied so that the tests may be most thorough. The English engines each cost $19,000, while the Baldwin and Pittsburg each cost $13,500. The locomotives each approximate the same weight. The result of the trials, however, is at present in favor of the English locomotive, since, though its initial cost was $5500 greater than the American engines, this sum is saved in coal consumption and in increased haulage power.

The completion of this railroad will result in a tremendous acceleration of communication between Europe and the East, and also San Francisco, and the distance will even be shorter than via Panama, as the following table will show:

	Via Panama.	Via Tehuantepec.
New York to San Francisco	6,270 miles.	5,005 miles.
Plymouth, England "	9,102 "	7,787 "
New Orleans "	5,598 "	3,585 "

At both ports the facilities for handling cargo will be of the most up-to-date labor-saving description. Electric cranes replete with all the modern time-saving equipments will be erected at the wharves at both Coatzacoalcos and Salina Cruz. By this means a vessel arriving at either port will have its cargo discharged into the train, transshipped across the Isthmus, and reloaded upon the opposite seaboard within 24 hours. This is far less time than would be occupied in crossing the Isthmus by canal. The cost of crossing the continent will also be far less by the railroad than by the waterway. Freight will be carried from one vessel to another at $4 per ton, including discharging and reloading at the ports. Facilities for handling and transshipping 1,000,000 tons each way per year are being made.

Already arrangements are being prepared in England and the East to establish Tehuantepec as a great trade route. Negotiations are in progress for a regular Japanese steamship service from Salina Cruz, the Pacific terminal for the line, direct with Yokohama; another to Yokohama via other ports; and also a direct steamship line to San Francisco; while the Pearson company are also contemplating the inauguration of other steamship services to other ports. On the Atlantic side, English steamship companies trading with the East have arranged for a regular steamship service direct from Liverpool to Coatzacoalcos, immediately the dock accommodation is provided. From these facts it will be recognized that the success of the Tehuantepec Railroad is assured. The most salient advantage of this route for trade over the Isthmian canal is that it will be both cheaper and quicker. Then again its cost of maintenance will not be so great. Owing to the peculiar seismic nature of the country there is a great liability of the traffic upon the canal being seriously interrupted by earthquakes, and since it does not require a very severe disturbance to throw a lock gate out of gear this is a serious consideration. Any damage inflicted upon the railroad from this cause can be sufficiently remedied in a few hours to permit traffic being resumed.

SIBERIAN REINDEER SADDLE AND CRADLE.

PRIMITIVE REINDEER SADDLE AND CRADLE FROM NORTHEASTERN SIBERIA.

BY WALTER L. BEASLEY.

The American Museum of Natural History has just received a noteworthy collection of objects obtained by the Jesup North Pacific Expedition from northeast Asia. From the wealth of material gathered this is considered one of the most important ethnological investigations yet made by the institution. The purpose of the expedition was to study those tribes of northeastern Asia which are supposed to be closely related in custom and culture to the northwest coast natives of North America; also to obtain utensils, weapons, dresses and miscellaneous household articles, which would fully illustrate the material life of the people. A comparison of these, it is thought, will do much to clear up the great problem as to the history and origin of the people of northeastern Asia. Some ten thousand specimens were collected by Mr. W. Bogoras, connected with the Academy of Sciences, St. Petersburg, while Mr. W. Jochelson, his partner, collected the same number of objects from different territory. A year was consumed by Mr. Bogoras in traveling by dogs and reindeer teams over a vast area. He visited six tribes, the most of whom were extremely primitive and had never seen a white face before. Among the unique and striking objects brought back were a reindeer saddle and several cradles, constructed of a framework of birch boards, covered with reindeer skin. The leading feature of these specimens, aside from their novel shape, is their beaded decorations. They belong to the Lamut tribe of hunters and Asiatic Eskimos. Though primitive and living nearly in a barbarous state, the women, however, are capable of doing excellent beadwork. These designs are placed on their wearing apparel, cradles, and deer saddles. Reindeer herding and the pursuit of game is the sole occupation of this tribe. All clothing is made from reindeer skin. The animals bred by the Lamut tribe command a double price, as they make the best teams. The neighboring tribes are willing to pay this bonus, as the half-wild animals from other sources are slow and indifferent for traveling purposes. The reindeer is also a main source of food supply. The flesh, blood, rims of the horns, hoofs and the gristles of the ears and nostrils are all consumed raw or cooked. Even the half-digested moss taken from the paunch is cooked with fat and roots as a porridge. Transportation is mostly done by the reindeer. Having a tender back and a peculiar swaying motion, said to be greater than that of the camel, the saddle is shaped to fit a certain portion near the shoulder. In place of stirrups a wooden flap board is used to hold the rider in place. The inside is padded with moss and covered with several layers of deerskin. The cradle, having a young child tied within in a seated position, is strapped to the side of the animal while on its journey. A heavy fur covering is tightly drawn over the cradle to shut out the cold. It was found that the folklore and traditions of many of the Siberian natives were similar to those of the North Pacific coast tribes, especially the legend of the Raven, who is regarded as the creator of the world and man in both countries. Mr. Bogoras is now at work at the Museum on a memoir, which will cover some 2000 pages. In this will be set forth the mythology, as well as the daily life of the people of northeastern Asia. Some 190 tales of the Chukchi tribe, obtained by Mr. Bogoras, are now being printed by the Academy of Sciences, St. Petersburg. According to Dr. Franz Boas a study of the natives of northeastern Siberia seems to reveal the fact that these tribes are more closely associated in culture and in physical form with the Indians of the North Pacific coast than with the Eskimo of Alaska, which justifies the conclusion that the latter are probably recent occupants and not the pre-historic dwellers of this district.

What is "Lloyds"?

Primarily "Lloyds" is a corporation employed in marine insurance and having a world-wide agency for the collection of marine intelligence. Incidentally other insurance is taken. "Lloyds" had its origin in the enterprise of Edward Lloyd, a London coffee house keeper, whose place, opened in 1688, became a resort for shipowners and ship captains. So much was learned of marine matters, and so general became the interest in this information, that in 1692 an office was opened in Lombard Street, and shortly afterward Lloyd's News, a paper issued three times a week, and devoted to shipping news, made its appearance. Adverse criticism by the paper of the British government, coupled with a demand for an apology for an item of news which appeared in the paper, decided Mr. Lloyd to discontinue the publication. The insurance feature of "Lloyds" originated from a method of mutually insuring or "underwriting" each others' shipping risks by the owners frequenting Lloyd's establishment. Their method of doing this was to subscribe or "underwrite" their names to a document which stated the amounts that each was willing to give in the event of disaster to the risk. The present system of "Lloyds" does not differ in any essential particular from the method employed at the beginning, but it is much better organized and the business has been vastly increased in volume. Its radius of operation now practically covers the whole world.

Launch of a Seven-Masted Schooner.

On the afternoon of July 10 the seven-mast schooner "Thomas W. Lawson" was launched from the yards of the Fore River Ship and Engine Company. A full description of the vessel has already appeared in the Scientific American. It will be merely necessary to recapitulate her chief dimensions, which are:

Length over all, 403 feet; beam, 50 feet; depth, 36 feet; height of masts, deck to truck, 150 feet 6 inches; total sail area, 43,000 square feet; cargo capacity, 8100 tons; displacement, fully laden, 11,000 tons.

Foreclosure proceedings instituted by first-mortgage bond-holders have resulted in the sale of the St. Lawrence Power Company's plant at Massena, N. Y., described in the Scientific American for November 17, 1900. More than $10,000,000 is said to have been spent in the Massena power scheme. The financial failure of the project is due principally to inability to dispose of the power generated.

THE FORMATION AND GEOLOGY OF THE SALT DEPOSITS.

BY F. C. JONES.

When this planet emerged from its long aqueous night, and the new-born internal forces began the work of creating the continents, the conditions essential to the formation of saline deposits prevailed. Salt was the predominating mineral held in solution by the water, and may even have been an element of the primary rocks. During the mighty uplifts, numerous depressions filled with salty water were, naturally, elevated above the ocean level. Some of the lakes thus formed had the magnitude of seas. The most of them probably had no inlet or outlet. Others may have had both for a considerable portion of their existence, but a gradual diminution of the water supply would finally force the lake below the level of the outlet. Evaporation then produced a gradually strengthening brine, which eventually became so heavy that the salt crystals began settling to the bottom of the lake.*

All deposits formed in this manner are necessarily of great antiquity. Another class of deposits, comparatively recent, was formed from what were originally fresh-water lakes, and many of these lakes probably occupied valleys once dry. In such cases, the salt came from tributary streams, whose washings for hundreds of thousands of years, coupled with evaporation, finally produced conditions identical with those which obtained in the more ancient lakes.

There is yet a third and smaller class of deposits which have no particular age classification. Occasionally a land-locked bay was detached from the ocean by the formation of a sandbar across its mouth. It then became a great natural evaporating pan. The supply of salt water was derived from the influx of the tide over or through the sandbar. Since only water sufficient to replace that lost by evaporation could enter, the precipitation continued without interruption until some disturbance of nature either submerged the bay or elevated it above the ocean level.

Very little saline precipitation results from a body of water until it has become greatly reduced in size. If the water were originally of the same strength as that of the Atlantic Ocean, only approximately one-seventh of the first bulk would remain, provided there were no tributaries. To better illustrate this statement, suppose a lake 1000 feet deep, with perpendicular sides and a level bottom. Not until evaporation had reduced the depth to about 143 feet would the real work of making a deposit begin. Of this remaining 143 feet, 35 feet would be solid matter, chiefly salt. Since the ancient lakes were probably on the same lines as those of the present day, they must originally have covered from two to six times the area of their salt beds, the deposit representing only the deepest portion.

If we allow that, as a rule, these lakes covered three times the area of their deposits and that their average depth was one-third of their greatest depth, we have the equivalent of the preceding paragraph. Based on this proposition, a deposit 50 feet thick would presuppose a lake having a maximum depth of 1430 feet, by using the Atlantic's percentage of solid matter (0.035), although the ancient oceans were undoubtedly less saline. The greater part of the thicker deposits was probably contributed by streams (which were comparatively fresh) or by tides, as some of them would have required a depth of water much greater than now exists in the open ocean.

There is nothing improbable, consequently, in the supposition that some deposits 200 feet thick or more came from lakes which never had a depth exceeding 2000 feet. In such a case, the original contents of the lake would account for 70 feet of the deposit, leaving 130 feet to be derived from other and generally less prolific sources. Tributary streams are a factor wanting in the case of land-locked bays, while a deposit of any given thickness which came from a lake originally fresh would require a much greater volume of water. These figures are, of course, conjectured, but they indicate the proportion the salt deposits must bear to the bodies of water from which they were derived.

Any estimate of the length of time consumed by nature in making a deposit would be pretty much at random. The size of the lake basin, the seasons, and the number and size of streams are important factors of which we have no knowledge. From the number of alternating strata of shale and salt found in some deposits, however, we know that there were numerous seasons of excessive rains, when the streams furnished sufficient water to raise the lake level many feet—perhaps to the overflow point. At such times the water became fresher and saline precipitation was indefinitely suspended. These seasons were not such in the modern meaning of the word, for they probably comprised scores or even thousands of years. The layers of mud, which later became hardened into shale, were thickest and most numerous near the mouths of the streams, but they occasionally covered the entire bed of the lake. Judge of the volume of water discharged and the amount of sediment it must have carried in order to cover areas of more than a thousand square miles with a layer nowhere less than several feet thick!

Although the chief substance found in ocean water is chloride of sodium, it contains very small amounts of other minerals. Its average density is about 1.025.

Fig. 1.—Contour of a supposed lake showing the proportion of salt which would come from its original contents. *A, A*, original level of the lake; *B, B*, thin layer of gypsum; *C, C*, deposit of salt; *D, D*, point from which the water receded after the gypsum was deposited but before the saline precipitation occurred.

Of the 0.035 per cent of solid matter in the Atlantic ocean, less than 0.030 per cent is salt. The various minerals and their percentages of the total matter are as follows: Chloride of sodium, 77.07; chloride of potassium, 3.84; chloride of magnesium, 7.86; sodium and magnesium bromide, 1.30; calcium sulphate (sulphate of lime or gypsum), 4.64; magnesium sulphate, 5.29. While this list fairly represents the ingredients of the ancient lakes, the percentages have very little bearing, owing to local causes. Particularly noteworthy is the greater proportion of gypsum in some of the deposits.

Fig. 2.—Present size of Great Salt Lake and two of its prehistoric stages.

These minerals do not all separate from water at the same stage of evaporation or density. Distilled water at the temperature of 60 deg. Fahr. is the unit of comparison. The first mineral to separate is the calcium sulphate, when a density of about 1.13 has been reached—equivalent to 17 per cent of solid matter. If it is deposited under a pressure of ten atmospheres (about 146 pounds to the square inch), or at the bottom of a lake 335 feet deep, it will contain no water of crystallization and is called anhydrite. Usually, however, it includes a considerable percentage of water, and then it is more properly known as gypsum. Following the gypsum comes the chloride of sodium, the precipitation taking place in a density ranging from about 1.20 to 1.30. This includes the sodium bromide. The last to precipitate are the magnesium and the potassium. If the process were interrupted by an unusual inflow of fresh water, the order of precipitation would be repeated from the beginning.

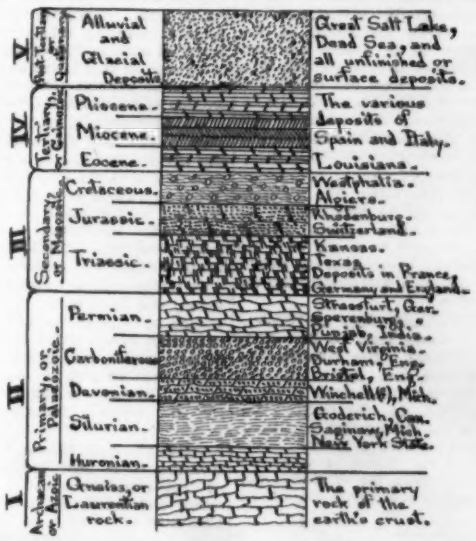

Fig. 3.—Geological location of the principal salt deposits. Geological time to produce periods II, III, IV, and V is estimated at from 10,000,000 to 60,000,000 years.

Judging from the number of strata of the different minerals found in some deposits, this was the rule rather than the exception.

For much of our knowledge regarding the formation of salt deposits, we have only to study the modern examples in various stages of completion. The Dead Sea, 40 miles long, 9 miles wide and 1,286 feet below the level of the Mediterranean, is a noted example. Its greatest depth is 1,100 feet, but all of the southern end below the peninsula of Lisan, or about one-fourth of its area, is very shallow, nowhere exceeding 13 feet. The principal contributing stream is the river Jordan, which is said to carry 52 parts chloride of sodium and 30 parts chloride of magnesium to every 100,000 parts of water. The water of the sea itself long ago reached the point of saturation and now contains 24 per cent of solids. A little over one-third is chloride of sodium, the greater proportion being made up of chloride of magnesium and calcium chloride. This is excellent proof that the brine is very old, most of the salt already having been precipitated.

The Dead Sea is probably the remnant of a larger one, formed by the uplift which drained a large portion of Western Asia, joined that continent to Africa and nearly imprisoned the Red Sea. Ancient beach lines, from the level of the Mediterranean down, indicate the successive changes through which it has passed. It once had an outlet southward into the Gulf of Akabah by way of the narrow valley of Akabah. A saline plain which extends many miles to the south shows that precipitation occurred long before it became contracted to its present area. The shallow southern end may once have been dry land (as the Bible seems to indicate), the resubmersion taking place during the eruption which destroyed Sodom and Gomorrah. This, however, would affect the level of the sea only a few feet, and proves that in 3,800 years there has been surprisingly little change.

The finest example of natural salt making, however, is to be found in our own country. Great Salt Lake is the largest body of brine in the world. It has a singularly great elevation of 4,200 feet, considering the fact that salt lakes are usually near or below the ocean level. The area which it covers greatly varies from the wet to the dry seasons (winter and summer), but upon the average it is about 70 miles long and 30 miles wide. Four rivers flow into it—the Jordan from the south, the Bear from the north and the Ogden and the Weber from the east, besides many minor streams. Despite this great influx of fresh water, the lake contains 23 per cent of solid matter, nearly all of which is chloride of sodium. It is extremely shallow, the greatest depth being only about 35 feet, while the average is little more than one-third of that.

The basin which Great Salt Lake originally occupied is of very irregular shape. The surface of the lake was then about 1,000 feet higher than it now is. Its extreme length was 346 miles and extreme width 145 miles, the total area being 19,750 square miles, or more than nine times its present size. At that level it remained thousands of years, making a well-defined shore line on the surrounding mountains. To this stage of its history geologists have given the name of Lake Bonneville. A second great and even more prolonged stage occurred when the lake had fallen to the 625-foot level, and this is known as the Provo shore line. During both stages it had an outlet northward by way of the Snake and the Columbia rivers. Besides the season changes, the level of the present lake fluctuates through periods of considerable length not yet clearly determined. In 1847, it covered an area of 1,700 square miles, but in 1869 the area had increased to 2,360 square miles, its extreme dimensions being: Length, 83 miles; width, 51 miles; depth, 49 feet. A decrease then began.

Salt deposits are common to nearly every formation of the earth's crust and constitute a sort of a geological step-ladder which the average layman can understand. The point-blank assertion that millions of years were required to lay down the deposited portion of the earth is apt to stagger him. A stratum of rock hundreds of feet thick conveys no meaning to him because he knows nothing of the process by which it was formed. Judging from the slowness with which the modern deposits are being laid down, however, he can get an idea of the almost illimitable time that some of the ancient and larger deposits must have required. Many of them were completed long before either the continents or oceans were inhabited. Neither animal nor vegetable life could have survived the oft-repeated and awful convulsions of nature which emphasized their history. Placed in comparison, Niagara and the great chain of inland seas are as infants of to-day. Even the great glacier which preceded them and is supposed to have lasted about 30,000 years, belongs to the post-tertiary or present period of the world's existence. Back of this are three great periods comprising a dozen different formations!

* Under ordinary conditions, water can hold in solution about 25 per cent of salt. In salt making, this is known as the point of "saturation."

RECENTLY PATENTED INVENTIONS.

Agricultural Improvements.

PLOW.—J. Michalka, Cameron, Tex. The shoe-bar in this plow is rigidly secured to the beam and the standard is arranged to permit quick and convenient adjustment to any height or depth of cut and any inclination found necessary in setting the plowshare or sweep. Means are provided for adjustably locking the standard brace to the standard in such a manner that the standard cannot be accidentally moved from position.

Apparatus for Special Purposes.

GAS-PRODUCING APPARATUS.—J. H. Miller, Jr., Irwin, Pa. This apparatus is more particularly adapted for making illuminating gas and comprehends a novel, co-operative, and peculiar arrangement of parts, whereby a large amount of heating surface is provided, and in charging the apparatus the nitrogen is driven off and the desired gas product is left practically free of nitrogen. By this construction five hundred to six hundred heat units may be obtained as against three hundred and fifty secured in water gas.

Electrical Apparatus.

ELECTRIC BATH APPARATUS.—J. D. Randall, Memphis, Tenn. The invention relates to improvements in cabinets for giving electrically-heated air baths to invalids afflicted with various forms of diseases. The apparatus is so arranged that it may be lowered or placed over a person and produce varying degrees of heat by an electric current.

SOCKET-COVER AND GLOBE-HOLDER.—J. F. Weide, Brooklyn, N. Y. The improvement provides a combination of a socket-cover and globe-holder for an electric lamp which can be readily and securely placed in position to cover the lamp-socket and to form an exceedingly strong globe-holder requiring no separate attachment on the cover.

POLE-CHANGER.—J. M. G. Beard, Fruita, Col. This pole-changer is more particularly used for electricity of high potentials, such, for instance, as currents from static machines, induction coils and oscillators, and the device affords a simple and effective means for changing the direction of the currents.

Hardware.

ADJUSTABLE SOCKET-WRENCH.—J. L. Paxson, Mobile, Ala. The wrench consists of two members which are flat at their centers and beveled upwardly at each end, thereby forming a rocking fulcrum at the centers. A sleeve or nut is slipped over the smaller end of the wrench and engages a thread on the outer surface of these members. By sliding or screwing the sleeve or nut in either direction, the half-sockets in the opposite faces of the two members are made to approach each other and grip the object between them.

VISE.—F. I. Webber, Oxford, Neb. This vise or holder is more especially designed for securely gripping the sucker or plunger rods of tubular wells, or the drill rods of well-drilling apparatus, or other work undergoing repairs and the like. The vise is very simple in construction and effective in operation, and is arranged to prevent the work from sliding or turning in the jaws.

BENCH-CLAMP.—V. F. Simola, Bergenfield, N. J. This bench-clamp which is simple in construction, and of economical form may be attached to any carpenter's bench. The design is such that curved or straight articles may be firmly gripped and held in position to be worked upon, and articles may be held above the bench and turned in their supports as required.

Improvements in Motors and Engines.

REVERSING VALVE-GEAR.—A. B. Leftwich, Pueblo, Colo. In the ordinary link-motion for locomotives two eccentrics on the axle are required for each valve. In this invention only a single eccentric is employed for each valve and a simple construction of reversing gear is provided which is susceptible of the two positions necessary to reverse the valve, and a middle position which has no influence on the valve, as well as various intermediate positions.

PULSOMETER.—P. Haussmann, Burg, near Magdeburg, Germany. This invention relates to steam water-lifters or pulsometers and more particularly to the construction of the injecting nozzles which produce the condensation of the steam. These nozzles are so arranged as to render the injector-tube adjustable, while the mouth of such tube is adapted to act in conjunction with the spraying device provided in the interior of the chambers, whereby it is possible to regulate the quantity of the refrigerating water to existing conditions of working.

SLIDE-VALVE GEAR.—S. S. Younghusband, Darlington, England. The invention consists in the special construction of eccentric sheave and stud for working the expansion or reversing link of the valve-gear of a locomotive. Motion is transmitted from the reversing links to the slide-valve through an intermediate lever, having a pivotal connection with the die-block of the link. This lever is connected by its shorter arm to the valve-rod and suspended by its other arm from arms on the way-shaft. The connection with the expansion-link of the link-suspension device and the rods of the forward and backward eccentrics is effected by means of gudgeons carried by a pair of cheek-plates fixed to the expansion ling at either side thereof.

WIND-MOTOR.—J. M Cochran, Gober, Texas. The construction of this wind-motor is simple and durable and is arranged to permit the use of large wind-wheels without danger of creating undue tortional or other strains. The construction also permits the vane to freely hold the wheel into the wind and to insure a proper transmission of the power developed.

CURRENT-WHEEL.—J. A. Wells and J. D. Sumrall, Knight, Tex. The paddles of this current-wheel are mounted to slide upon the spokes of the wheel in order to prevent breakage by drift material and to prevent the wind acting detrimentally upon the paddles. The invention also utilizes the power generated by the movement of the wheel to raise and lower said wheel whenever the condition of the stream may require such adjustment to enable the paddles to act upon the water advantageously at all times.

Machines and Mechanical Devices.

HOIST.—C. Petty, Oakwood, Tenn. The invention relates to a hoist adapted especially for lifting barrels, kegs, etc. The device may be employed for lifting and carrying barrels from one point to another and placing them or loading them upon the desired object without involving exercise of any considerable force.

ADDING-MACHINE.—E. Wiswall, Island, Ill. The invention is in the nature of a novel form of adding-machine which will also aid in solving problems in subtraction, multiplication and division. It consists of a peculiar construction and arrangement of parts, particularly adapted for the uses to which it is put. On each side of the case of the adding mechanism there is a row of figures opposite the keys to facilitate the working of problems in subtraction and division.

CANE-LOADER.—H. S. Padgett, Waipahu, Hawaii Territory. The cane loader is employed in loading cane on cars or other carriers. In connection with suitable framing the machine is provided at the front with a transversely extending endless carrier which extends from side to side of the machine beyond the wheels and discharges from one end into an upwardly-inclined elevator. This elevator is designed to discharge the cane into a car or other receptacle.

LOG-TURNER.—W. L. Leland, Sisson, Cal. This log-turner is employed in sawmills to move a log from the log deck upon a log carriage, to conveniently and automatically turn the log over after several boards have been sawed off, and then to return the log to position against the knees of the head-block on the log-carriage.

PAPER-JOGGER.—W. E. Jelf, Chattanooga, Tenn. The invention relates to a device for jogging or jolting superimposed sheets of paper so that they will be caused to assume positions in which their edges lie true with respect to each other. Thus preparing the sheets for binding, cutting and analogous purposes.

WASHING-MACHINE.—J. Woerndl, Frances, Wash. This washing-machine belongs to that type used upon the top of wash-tubs and operated without direct submersion in the water. The clothes to be washed are wet, spread out, and rubbed with soap, and then bundled up into a ball. This ball of clothing is then rolled forward and backward, the internal surfaces rubbing against each other with a gentle friction, thus loosening the dirt and causing the same to mingle with the water.

SCALE ATTACHMENT.—W. D. Evans and J. T. Marshall, Eupora, Miss. The invention relates to improvements in attachments for weighing-scales and provides a device of simple construction, designed to co-act with the scale beams to indicate on the dial the weight of an article on the scale, and obviate the use of the usual weights.

EXPANSIBLE PULLEY FOR MOTOR-VEHICLES.—Paul Isidore Viel, 99 Rue de la Verrerie, Paris, France. The invention relates to transmission and speed gear for motor vehicles and is characterized by extensible pulleys which enable the ratio of the diameters between the driving and driven pulleys to be altered in such a manner as to alter the speed of the driven shaft in the same ratio. Furthermore the extensible pulley permits of instantly stopping the driving belt.

Miscellaneous Inventions.

SHEARS.—R. Hamilton, Pensacola, Fla. This invention is an improvement in shears designed for cutting heavy material. A base plate is employed in connection with the lower blade to slide beneath the material being cut. The construction is such that the handle of the fixed blade may be grasped by the thumb and forefinger of the hand in such manner as to hold the shears steadily in operating and guiding the same, while the handle of the upper blade may be operated by the other fingers of the hand.

TOBOGGAN-SLIDE.—E. C. Merrill, New York, N. Y. This toboggan-slide is so arranged as to secure the novel effect of cars racing side by side at a varying rate of speed, whereby it becomes possible for the cars to take the lead alternately, thus adding considerably to the enjoyment of the occupants of the cars.

DETONATOR FOR RAILWAYS.—F. Lemaire, Paris, France. This detonator possesses the advantage of exploding loudly upon the passage of the first vehicle or of the locomotive, so that the explosion is always audible to the driver. The improved detonator does not injure or deteriorate either the rail or the tire of the wheels, and in addition affords great security owing to the certainty of its operation. It is adapted to resist accidental shocks which may arise from falls during transportation, or from knocks or blows during storage.

CHAIR.—H. P. Blackard, Omaha, Ill. This reclining chair is so arranged that a person while on the chair may readily adjust it to any desired angle from an upright or sitting position to a reclining position. It may be readily adjusted to a sitting position by the weight of the person rising from the sitting position, or in other words the chair is self-adjusting to any point on upward movement.

FIRE-ESCAPE.—E. M. Christ and W. I. Haldeman, Pinegrove, Pa. The invention resides in a peculiar form of spiral around which the rope is wound, in order to give the rope the number of turns sufficient to furnish the necessary resistance to the movement of the rope. The construction of the spiral permits the rope to engage and disengage the ends of the spiral without turning sharp or abrupt corners which would obviously tend to prematurely destroy the rope.

WATER-RESERVOIR FOR RANGES.—G. H. Grimm, Rutland, Vt. This water-reservoir ensures quick heating of the water and aids in the combustion of the fuel. The generation of steam is reduced to a minimum, and its escape into the room or into the reservoir casing and range are prevented, thus avoiding the formation of a destructive alkali by the mixing of the steam with soot and ashes.

REPEATING FIREARM.—W. W. Humphreys, Sheffield, Ill. The improvement relates more particularly to repeating shotguns of that type in which the receiver is open at the bottom. The construction permits the shooter to expel one or all the cartridges from the magazine by the magazine spring, so that at the end of a hunt the sportsman can unload his gun with rapidity and perfect safety, avoiding danger of accidental explosion.

CAMERA AND FOCUSING - FINDER THEREFOR.—U. Nehring, New York, N. Y. The invention relates more particularly to the production of a combined camera and means for automatically finding an object and focusing the camera upon said object. Means are provided for reducing the volume of the finder and focuser so that the same will be in as compact form as possible.

WINDOW ATTACHMENT.—R. Hamilton, Pensacola, Fla. This improvement is in the nature of means for carrying the shade roller and lace curtain on the upper sash of a window and comprises devices whereby the sashes may be locked when closed or opened to any desired extent.

METHOD OF RAISING SHEETS OF STONE.—A. W. Pratt, North Jay, Me. Mr. Pratt has invented a new method of quarrying or raising sheets of stone from the mother ledge or solid mass where there is no natural bed or seam. The sheet of stone of required thickness may, by this process, be raised or separated without flaw or fracture and brought to an edge, so that it can be cut up into blocks or slabs of suitable dimensions for use in the erection of buildings, monuments, etc.

NECKTIE-HOLDER.—P. M. Lewis, New York, N. Y. The improvement consists of a clip member attached to a shield and adapted to engage with the collar-button. The holder-clip is so formed as to engage yieldingly with the back of the shield at a considerable distance from its center, thus preventing the bending and consequent breaking of the shield, but permitting it to conform to a collar.

INCANDESCENT GAS-BURNER.—A. A. Pratt, New York, N. Y. The object of the invention is to provide a new and improved incandescent burner which is simple and durable in construction and arranged to give a very bright light on high or low gas pressure and without increase in the consumption of the gas over ordinary incandescent burners now in use.

TABLET.—A. L. Holton, Norfolk, Va. This invention is an improvement in paper tablets of that class comprising a number of loose leaves and means for holding them together. This holding means is of such a construction as to permit the sheets as they are filled to be turned back until they lie perfectly flat. When all the sheets have been used the tablet may be reversed and the opposite sides of the leaves used.

NOTE-BOOK.—A. L. Holton, Norfolk, Va. This invention is an improvement in note-books designed for use by stenographers and others, the notes of which are to be transcribed. The invention has for its object to provide a simple construction by which the note sheets may be held, will lie flat from end to end and throughout the entire pile, and can be readily applied and removed in use.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Die work, experimental work and novelties manufactured. American Hardware Mfg. Co., Ottawa, Ill.

Inquiry No. 2909.—For makers of electric curry-combs.

We design and build special and automatic machinery for all purposes. The Amstutz-Osborn Company, Cleveland, Ohio.

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For Machine Tools of every description and for Experimental Work call upon Garvin's, 149 Varick, cor. Spring Streets, N. Y.

Inquiry No. 2911.—For makers of castings for gasoline engines.

Ideas Developed.—Designing, draughting machine work for inventors and others. Charles E. Hadley, 594 Hudson Street, New York.

Inquiry No. 2912.—For makers of invalids' tricycles.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2913.—For a model of a turbine and an electric motor for school purposes.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 2914.—For a machine for punching small, round pieces of paper of different colors, called confetti.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2915.—For makers of flexible shafting.

Inventions Developed.—Designing and building of labor-saving machinery and general engineering. L. J. Zimmerman, Elect. and Mech. Engineer, 106 Center St., N. Y.

Inquiry No. 2916.—For dealers in compressed air machines or small, portable hand power machines.

Wanted—As instructor in pattern making in an eastern school of engineering an intelligent, young, energetic pattern maker with exceptional knowledge and skill at his trade. Good salary. Address, stating age, nationality, education and experience in detail, "Instructor in Pattern-making," Box 773, N. Y.

Inquiry No. 2917.—For the maker of the "Wold" shaper.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 2918.—For manufacturers of aluminium castings.

Good 6-inch equatorial telescope. Cheap. For astronomy, sea or mountain use. Full set, embossed. Scientific American and Supplement, from 1861, 84 vols. Virgil Buell, M. D., Plainville, Conn.

Inquiry No. 2919.—For makers of fans for restaurants, run by gasoline motors.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 2920.—For makers of spoke and handle making machinery.

Inquiry No. 2921.—For manufacturers of merry-go-rounds.

Inquiry No. 2922.—For parties to make a soft steel band ¾ inch wide and No. 32 gage, hot rolled, if possible, and put up in coils.

Inquiry No. 2923.—For manufacturers of hemp-stripping machines.

Inquiry No. 2924.—For manufacturers of the necessary equipment of a plant for making bottles, window glass and common glassware.

Inquiry No. 2925.—For dealers in large quantities of air pumps, capable of being worked by hand and of compression of 20 to 50 pounds pressure.

Inquiry No. 2926.—For makers of small ice-making machines for domestic use.

Inquiry No. 2927.—For makers of plants for making wood alcohol.

Inquiry No. 2928.—For centrifugal wringers requiring not over two or three horse power.

Inquiry No. 2929.—For manufacturers or dealers in picture frame mouldings.

Inquiry No. 2930.—For manufacturers of gongs and bells for musical purposes.

Inquiry No. 2931.—For cigarette paper in rolls 1¼ inches in diameter by 4 inches in width.

Inquiry No. 2932.—For turbine wheels complete.

Inquiry No. 2933.—For dealers in regularly cut figures, such as soldiers, indians, etc., 1½ inches high, on a small, thin base, so as to stand erect.

Inquiry No. 2934.—For acetylene marine searchlights for use on launches.

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July 15, 1902,

AND EACH BEARING THAT DATE.

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Book, coupon collection and receipt, Cappeller & Patteson 704,856
Book or pad, manifolding memorandum, E. Z. Lewis 704,844
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Bottle cover, temperature preserving, F. T. Griffith 704,972
Bottle, non-refillable, T. P. Weible 704,605
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Building block and wall, C. F. Whittlesey. 704,606
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Car draft rigging, J. A. Hinson 704,802
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Cement, J. T. McKim 704,849
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Cigar bunching machine, M. M. Gardner .. 704,742
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Circuit breaker, automatic magnetic, W. M. Scott 704,974
Claw bar, Ketler & Britton 704,883
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Time recorder, workman's, Jaynes & Deubner 704,544
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Wrench, W. Neilson 704,659
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TRADE MARKS.

Apples, apple trees, scions, cuttings, grafts, roots and stocks, Stark Bros. Nurseries & Orchards Co. 38,635
Balms for nasal and catarrhal affections, Brown Manufacturing Co. 38,611
Boot and shoe linings and trimmings, fabrics for, Farnsworth, Hoyt & Co. 38,598
Calcium carbid, Electro Lamp Co. 38,629
Candy, chocolate, F. H. Roberts 38,620
Canned fancy sugar corn, Warfield Pratt Howell Co. 38,625
Cement, Portland, Texas Portland Cement & Lime Co. 38,634
Clocks, certain named, M. W. Cole 38,606
Compounds and preparations, certain named medical, F. E. Turn Bull 38,610
Corsets, corselets, gorgets, belts, bust holders, busks, whalebones or steels, and hose supporters, J. Lindauer 38,603
Detergent compounds used as auxiliaries to soap, E. Wright 38,628
Diuretics, H. K. Mulford Co. 38,615
Dress shields, Canfield Rubber Co. 38,599
Engines, gas, United States Gasoline Engine Co. 38,637
Flavoring extract, concentrated, Corriso Extract Company 38,621
Flour, wheat H. R. Kearny 38,624
Gas burners, G. Bray & Co. 38,636
Hair, chemical preparation for removing superfluous, O. Rudert 38,613
Hardware, certain named, Acme Mfg. Co. 38,607
Hooks and eyes, Victor O. Mills Co. 38,605
Hose supporters, I. B. Kleinert Rubber Co. 38,604
Hosiery, Pilling & Madeley 38,602
Insulating material, American Hard Rubber Co. 38,633
Intestinal astringents, H. K. Mulford Co. 38,616
Medicinal preparations in liquid and tablet form for cure of certain named diseases, S. H. Winstead Medicine Co. 38,609
Milk in powdered form, condensed, Casein Company of America 38,622

(Continued on page 69)

Mowers, reapers, binders, and parts thereof, Johnston Harvester Co.	38,638
Oils, illuminating, Galena-Signal Oil Company	38,630
Oils, lubricating, Galena-Signal Oil Company	38,631, 38,632
Ointment for aches and pains, M. M. McCurren	38,618
Paper and envelopes, writing, H. V. Wagoner	38,608
Remedies, horse, E. O. Parker	38,619
Salt, Diamond Crystal Salt Company	38,626
Silk piece goods and silk ribbons, Duncan & Stens	38,504
Soda and baking powder, baking, Church & Dwight Co.	38,623
Suppositories for local treatment of internal organs, H. R. Cousins	38,617
Syrup, soothing, L. E. Masson	38,612
Tonics, H. K. Mulford Co.	38,614
Trousers, Rosenthal & Goldberg	38,600
Undershirts, Athens Knitting Co.	38,601
Washing compounds, certain named, National Supply Co.	38,627

LABELS.

"Ambition Pills," for medicine, Larned & Barker	9,310
"American Wire Weavers' Protective Association," for Fourdrinier wire cloth, New Jersey Division of the American Wire Weavers' Protective Association	9,296
"Boro Salicine," for a medicine, Boro-Salicine Co.	9,307
"Cortes Portuondo," for cigars, I. Block	9,309
"Dr. Going's Creomote Compound," for medicine, Going Medicine Company	9,308
"Eggine Baking Powder," for baking powder, H. J. Brennecke	9,297
"Elkhorn," for cigars, Schmidt & Co.	9,305
"Foxy Grandpa's Tonic," for a tonic, H. E. Ehrman	9,306
"Indian Head Powder," for a medicine, J. H. Gress	9,309
"Nail Powder," for nail powder, E. Forquignon	9,312
"Our Congressman," for cigars, F. Hartmann & Son	9,301
"Puritan Boy," for cigars, Lincoln, Seyms & Co.	9,304
"Red Star Cigars," for cigars, W. H. Klenke	9,302
"Renton's Fluga Rheum," for a medicinal oil, H. T. Renton	9,311
"Star of Egypt," for cigarettes, Miebis Tobacco Co.	9,299
"The Dixie Candy Bin," for candy, G. Blome & Son Co.	9,298
"The Elk Cigar," for cigars, W. H. Klenke	9,303

PRINTS.

"Boiled Ham," for boiled ham, Armour Packing Company	535
"Men's Apparel," for men's apparel, W. C. Both	532
"Temptation," for cigars, American Cigar Co.	534
"The Vicereine $2.50 Shoe," for shoes, Shawe Godfrey Shoe Co.	533

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

NEW BOOKS ETC.

PRACTICAL CALCULATION OF DYNAMO ELECTRIC MACHINES. A MANUAL FOR ELECTRICAL AND MECHANICAL ENGINEERS AND A TEXT BOOK FOR STUDENTS OF ELECTRICAL ENGINEERING.—CONTINUOUS CURRENT MACHINERY. By Alfred E. Weimer, E. E., M. E. New York: Electrical World and Engineer. 1902. 8vo. Pp. 727.

The author is a well known electrical engineer, whose collection of dynamo data is one of the most complete existing in this country. Although intended as a text-book for students and a manual for practical dynamo designers, anyone possessing a fundamental knowledge of arithmetic and algebra will by means of this work be able successfully to calculate and design any kind of continuous current dynamo, the matter being so arranged that all required practical information is given wherever it is needed. The treatise as presented has originated from notes prepared by the author for the purpose of instructing his classes of practical workers in the electrical field, and upon the success experienced with these it was decided to publish the methods for the benefit of others. The work is devoted to the calculation, not the theory, of the dynamo. It is eminently practical and admirably fills a niche in the literature of electricity.

DISCUSSION ON THE TEACHING OF MATHEMATICS. THE BRITISH ASSOCIATION MEETING, GLASGOW, 1901. London: Macmall & Co. 1901. 16mo. Pp. 101. Price 80 cents.

The speakers who took part in the discussion are all men of great eminence, and the conclusions which they reached are of value to all mathematicians.

MUNICIPAL ENGINEERING AND SANITATION. By M. N. Baker, Ph.B., C. E. New York: The Macmillian Company. 12mo. Pp. 317. Price $1.25.

This volume is intended for the large and rapidly-growing class of persons who either as officials or citizens are striving to improve municipal conditions. It is designed to be a review of the whole field of municipal engineering and sanitation, rather than an exhaustive study of one or a few branches of the subject. Such matters as streets, pavements, sidewalks, bridges, ferries, water supply, sewerage, fire protection, public baths, administration, finances and public policy are all admirably treated.

We have received the fifth part of Foerster's "Eisenkonstruktionen," published by Wilhelm Engelmann, of Leipsic. The installment continues the discussion of hip-roofs. The method of inclosing steel roofs by glass as well as the general arrangement of glass roofs is thoroughly described. The concluding chapter treats of corrugated iron plate roofs. The parts still to come will be awaited with interest.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled

(8639) F. W. G. asks: I have a camera with two 1¼-inch diameter 7-inch or 7½-inch focus meniscus lenses, as illustrated on page 334, "Experimental Science," Fig. 2. I want to place a plano-concave lens between the meniscus lenses, same as Fig. 12. Of what focus must the plano-concave lens be? A. To adapt your lenses to portrait work after the manner described in "Experimental Science," page 334, Fig. 12, you will need a concave lens slightly stronger than 16 inches focus. A 14-inch lens should enlarge the image sufficiently for portrait work. The difference between a lens with 7½-inch focus and one of 8-inch focus is very slight.

(8640) J. W. E. and M. D. F. write for instructions for tinning cast iron. A. To be successful in coating cast iron with tin the castings must be absolutely clean and free from sand or oxide. The greater the care in cleaning at the outset the better the resulting work. Before the castings can receive a coating of tin it is necessary to remove the coating of scale or oxide, so the clean metal will be exposed to the tin. The castings are usually partly cleaned by means of a "rattler," which removes much of the scale. They are then to be placed in a pickle of dilute muriatic acid until a clean surface is the result. If the pickle is warmed by means of a steam jet the operation will be hastened. The castings can be examined occasionally while in the pickle and any sand or black spots removed by means of a scraper or wire brush. The castings can then be washed, and if desired kept for a length of time by being placed under clean water. As long as they are covered with water they are not subject to oxidation. For a flux the castings are dipped in a mixture composed of 4 parts of a saturated solution of sal ammoniac and 1 part of muriatic acid. "Boiled" acid, as that combined with zinc is sometimes called, is not to be used. For tinning the best block tin is required, and this should be melted in an iron pot, care being taken that it is not burned or overheated in melting. After the tin is melted it can be cleaned of impurities by taking a piece of green or wet wood secured to a pointed iron rod, and fastening same so the wood will be kept at the bottom of the pot of melted metal for one or two hours, depending on the amount of impurity in the metal. The surface of the metal is to be skimmed occasionally by means of a perforated iron skimmer. To protect the surface of the metal from oxidation it can be covered with sal ammoniac. There is nothing to be added to the tin. Another method is to cover the surface of the tin with tallow or palm oil. The casting is taken up by means of suitable tongs, dipped in the flux and then immersed in the melted tin and held for a sufficient time to allow the surface to be tinned. The tin should not be so hot as to discolor when casting is removed. If desired the casting can be held for a time in another pot, which is to be partly filled with tallow or palm oil and kept at a temperature that will melt tin. This bath of grease will allow the casting to retain an even coating of tin, and allow any superfluous metal to drain off. The castings may be cleaned from the grease by first rubbing in sawdust and then in bran.

(8641) E. B. C. asks for a good non-corrosive, easy-flowing jet black ink. A. An exceedingly fine ink is said to be produced by the following recipe: 11 parts galls, 2 parts green vitriol, 1-7 part indigo solution and 33 parts of water. Here the relatively larger quantity makes the gum unnecessary, while the indigo solution makes the brilliant black seem still deeper. Writing executed with this ink may, it is true, be removed by means of dilute acids, but it may be rendered visible again by chemical means.

(8642) M. E. H. writes: I have one of your 1901 receipt books, and consider it the best book of its kind on the market. I would not do without it. But I fail to find any receipt in it for oil paint such as used for painting photographic backgrounds, and would like to ask if you could help me to secure such a receipt. A. The following retains sufficient flexibility to enable the sheet to be rolled: Soft soap, 2 ounces; boiling water, 12 ounces. Dissolve and work well into usual oil paint, 6 pounds.